MARCH 1958

Power Engineering

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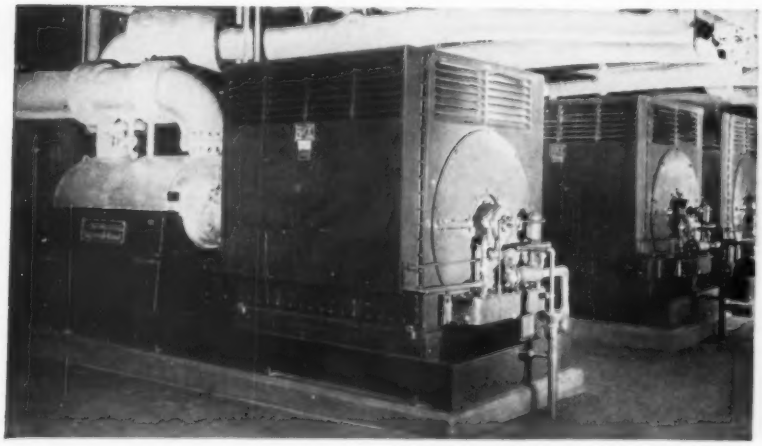
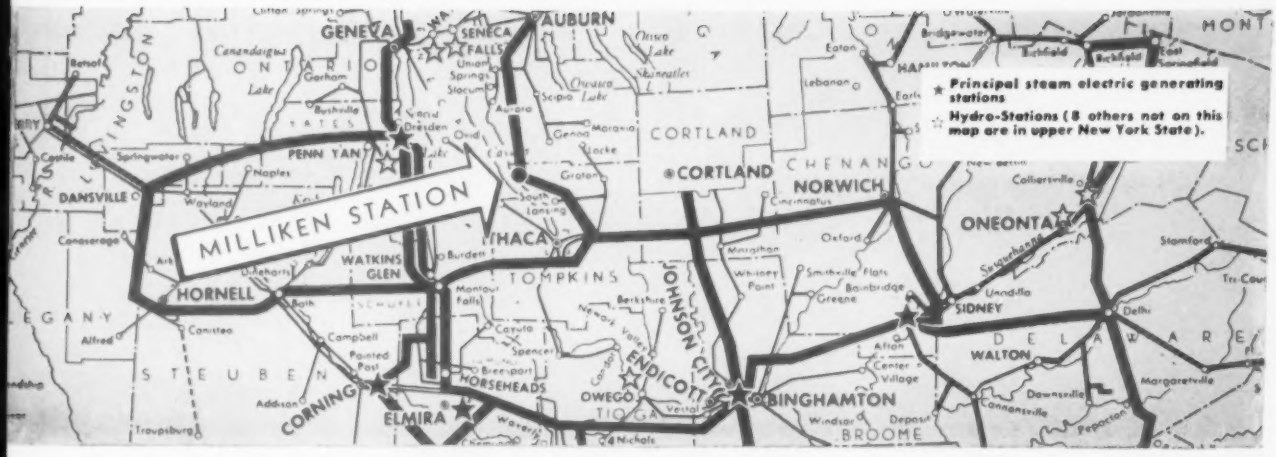
Once Again . . .
ELLIOTT
equipment was selected

Three Elliott hydraulic turbine-driven generators—one 8750 kva, and two 5000 kva—are serving the High Falls Hydro Station of the New York State Electric and Gas system.



The two Elliott 350-hp, 300-rpm vertical induction motors, seen above, drive the circulating pumps handling lake water at the Milliken Station.

Three Elliott 2000-hp, two-pole "super-quiet" induction motors, left, are driving the Milliken Station boiler-feed pumps.



Elliott Motors, Motor-Generators, Deaerating Heaters, Condensers and Twin Strainers have been used in various stations of New York State Electric & Gas System for many years.

Now, Elliott equipment is serving the Milliken Station

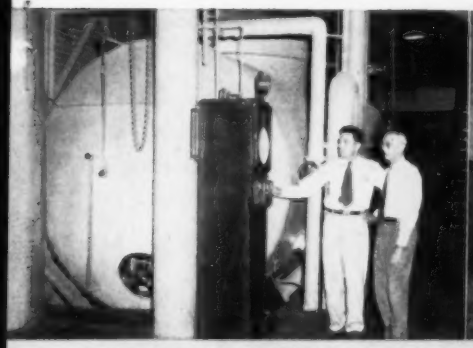
Back in 1852, eight men subscribed $75,000 as initial capital to incorporate a gas light company in Ithaca, New York. Today, as the New York State Electric & Gas Corporation, this aggressive company has more than 15,000 stockholders and a capital investment of over $330,000,000. Before the new Milliken Station was added last year, there were already five principal steam electric generating stations and 13 hydro-stations and the company was serving 35 per cent of the New York State area.

Selecting dependable steam and electrical equipment for an expanding organization of this type is vitally important. In this case, Elliott products previously installed in the company's various stations had already proven their dependability. Once again Elliott equipment was selected. The same thing has happened all over the country—again and again, *consistent, trouble-free performance has led to repeat orders.* For descriptive literature, call your nearest Elliott District Office or write Elliott Company, Jeannette, Pa.

ELLIOTT Company

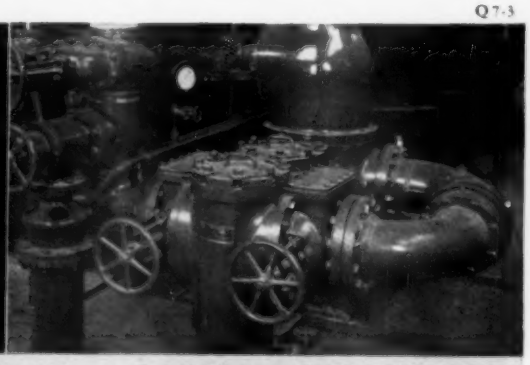
Steam Turbines • Motors • Generators • Deaerating Heaters • Ejectors • Condensers • Centrifugal Compressors • Turbochargers • Tube Cleaners • Strainers

Q7-3



An Elliott 210,000-lb-per-hr deaerating heater in the Greenridge Station, which has a vertical heater mounted on top of a horizontal storage tank.

An Elliott 27,000-sq ft divided water-box surface condenser, seen above, serves the No. 7 turbine in the Goudey Station.



Installed in the suction line to a gasoline-engine-driven fire pump at Milliken is this Elliott 8-in. twin strainer.

For more data circle 501 on Post Card

STEAM
...on schedule

Old Ben Coal is the "Old Faithful" fuel for low cost steam when you want it, where you want it. Although more than 200,000,000 tons of this genuine Franklin County coal have gone to market, there's still a hundred-year unmined supply.

Old Ben Coal corporation

360 W. Jackson Blvd.
Chicago 6, Illinois

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NBP BPA

PUBLISHED SINCE 1896 FOR POWER ENGINEERS IN PRIVATE AND PUBLIC UTILITIES AND INDUSTRIAL PLANTS

ENGINEERS' PREVIEW

U. S. WORLD TRADE FAIR is scheduled for the New York Coliseum, May 7–17. Of special interest to engineers will be the latest in high-quality imported machinery and precision tools. The exhibit will also include power equipment, electronic and electrical equipment, and motors.

Other meetings of interest: the 1958 AtomFair, sponsored by Atomic Industrial Forum at Chicago's International Amphitheatre, March 17–21; and the fifth annual Conference for Engineers and Architects, scheduled for May 2 on the campus of Ohio State University, under sponsorship of the university's College of Engineering.

The AtomFair will display a wide variety of products and services available from firms in the atomic energy field. The Fourth Nuclear Congress is connected with it, and will meet in the Amphitheatre at the same time.

Principal speakers at the Ohio conference will be Major General John B. Medaris, of the Army Ordnance Corps' Ballistic Missile Agency; and James C. Zeder, vice president, engineering, of the Chrysler Corp.

PERSONALS: At General Electric in Schenectady, N. Y., Lewis J. Burger has been named general manager of the Gas Turbine department. John P. Keller has been named to the position at G-E's Small Steam Turbine department in Fitchburg, Mass.

Lyle MacDonald, chairman of the board of Public Service Electric & Gas Co in Newark, N. J., announced his retirement February 1 after 42 years with the company. Donald C. Luce, as president, becomes the chief executive officer of the company. Luce reports that in the last five years, the company has spent over $500,000,000 for expansion and improvement in the system, this year will spend $160,000,000 more.

Clarence H. Clark, superintendent of Detroit Edison's Marysville power plant, has been selected to become superintendent of the new Enrico Fermi Atomic Power Plant now under construction near Monroe, Mich. Frank W. Shutko of the Power Reactor Development Co will be superintendent of the reactor section of the new plant. The steam turbine-generator station will be owned and operated by Detroit Edison on steam produced by the adjoining reactor plant. The Power Reactor Development Co is a non-profit corporation which will own and operate the nuclear reactor.

O. B. Schier, II, has been appointed secretary of the ASME, succeeding Clarence E. Davies, who was the Society's secretary for 23 years. Schier has been a member of ASME since 1932, and a staff member for the past 11 years. He is an M.E. graduate from Lehigh University.

BIG POWERMAKER has been ordered by the Potomac Electric Power Co. It's a 175,000-kw steam turbine-generator of the 3600 rpm/1800 rpm cross-compound, reheat type. It will be made by General Electric for installation in a new multi-million dollar power station on the upper Potomac River. Potomac Electric has also ordered a G-E boiler feed pump turbine, to be used mainly for standby duty, since the regularly used boiler feed pump will be attached to the main shaft of the 3600-rpm generator. This new type of station auxiliary is rated 6360 hp at 7000 rpm, and will use steam at 2400 psig at 1050 F.

ORDINARY SNAPSHOTS, taken by engineers, are being used successfully to obtain design information, reduce drafting, and to clarify instructions given to construction crews. All this leads to reduced costs of engineering projects. W. C. Foulke of Eastman Kodak Co has written a helpful paper on this practice, titled Some Uses of Photography in Engineering.

It's available from ASME, 29 W 39th St, New York 18. Paper number is 57-A-155.

CANADIAN POWER news includes completion of the installation of three more 50,000-hp water turbines at the Manicouagan Power Co's generating station near Baie Comeau, Quebec. Added to the two turbines already in operation, this boosts the station's capacity to 250,000 hp, enabling the plant to produce enough power to serve the first of four sections of a big new aluminum smelter plant at Baie Comeau, and also a pulp and paper mill. Quebec North Shore Paper Co and British-Aluminum Co own controlling interests in the smelter plant.

TOTAL OF STUDENTS enrolled in engineering in 1957 reached the highest level in our history — 297,000 — an increase of 7.2 per cent over 1956. Comments the Engineering and Scientific Manpower *Newsletter:* ". . . the major problem is no longer one of student recruiting but of educational equality all along the line."

HENRY T. HEALD, noted engineering educator and now president of the Ford Foundation, must have been thinking along the same line when he spoke on The Creative Mind at the annual meeting of ASME recently in New York. Said Heald:

"Today there are two nagging concerns about science and technology. The first is that Russia is producing more scientists and engineers than we are. The second is that Russia's successful launching of the satellite has relegated us to second place in the enforced race for scientific leadership.

"While I do not minimize in the least the propaganda advantage in the second, I submit that neither numbers nor temporary setbacks are conclusive determinants of leadership in the long run. What really concerns me is what we are doing now to encourage, develop, and sustain the creative mind in science and engineering."

Heald defined creativity as the insight that makes possible unscheduled leaps ahead. It is a tribute to the engineering profession, he feels, that in the midst of unprecedented popularity and tremendous pressure to multiply its efforts, many engineers have shown an increasing interest in creativity.

AGAIN, QUALITY, not numbers in engineering education, was stressed by Dr. Clark A. Dunn, vice president of the National Society of Professional Engineers. Criticizing President Eisenhower's proposal for 10,000 undergraduate scholarships annually for the next four years, Dunn said that the plan "will complicate and aggravate an already serious situation in the colleges." Dunn stated that studies of his group over a long period have indicated that the emphasis in science and engineering should be on quality rather than quantity. "The emphasis of a Federal program for collegiate education should be confined to graduate work and assistance to the colleges in meeting the crushing burdens of increasing undergraduate enrollments," he said.

IN BRAZIL, the successful start-up of the Institute of Nuclear Energy's research reactor in Sao Paulo marks the first time sustained nuclear fission has been achieved in Latin America. Built by Babcock & Wilcox Co, the reactor is designed to produce 5000 kw of power. This is said to be the highest capacity of any "swimming pool" type of reactor.

A 5000-kw gas turbine generator has been sold by Westinghouse to the seaport city of Fortaleza. Costing over $1,000,000 the unit will serve as a standby source during peak load periods at the Mucuripe station.

GREECE, TOO, gets a research reactor. The AEC has issued a license to American Machine & Foundry Co for export of a 1000-kw (thermal) pool-type reactor to the Greek Atomic Energy Commission for installation at the Democritus Nuclear Center in Athens.

"You never looked at me like that!"

NUCLEAR ENERGY FOR LOCOMOTIVE and other power applications has been under intensive study by the technical staffs of Baldwin-Lima-Hamilton Corp and the Denver, Rio Grande & Western Railroad, in concurrence with the Atomic Energy Commission. The engineering firm of Walter H. Kidde Associates has also been participating. Results to date have progressed sufficiently for the various managements to approve a long-range program of research on this important front of atomics for the future.

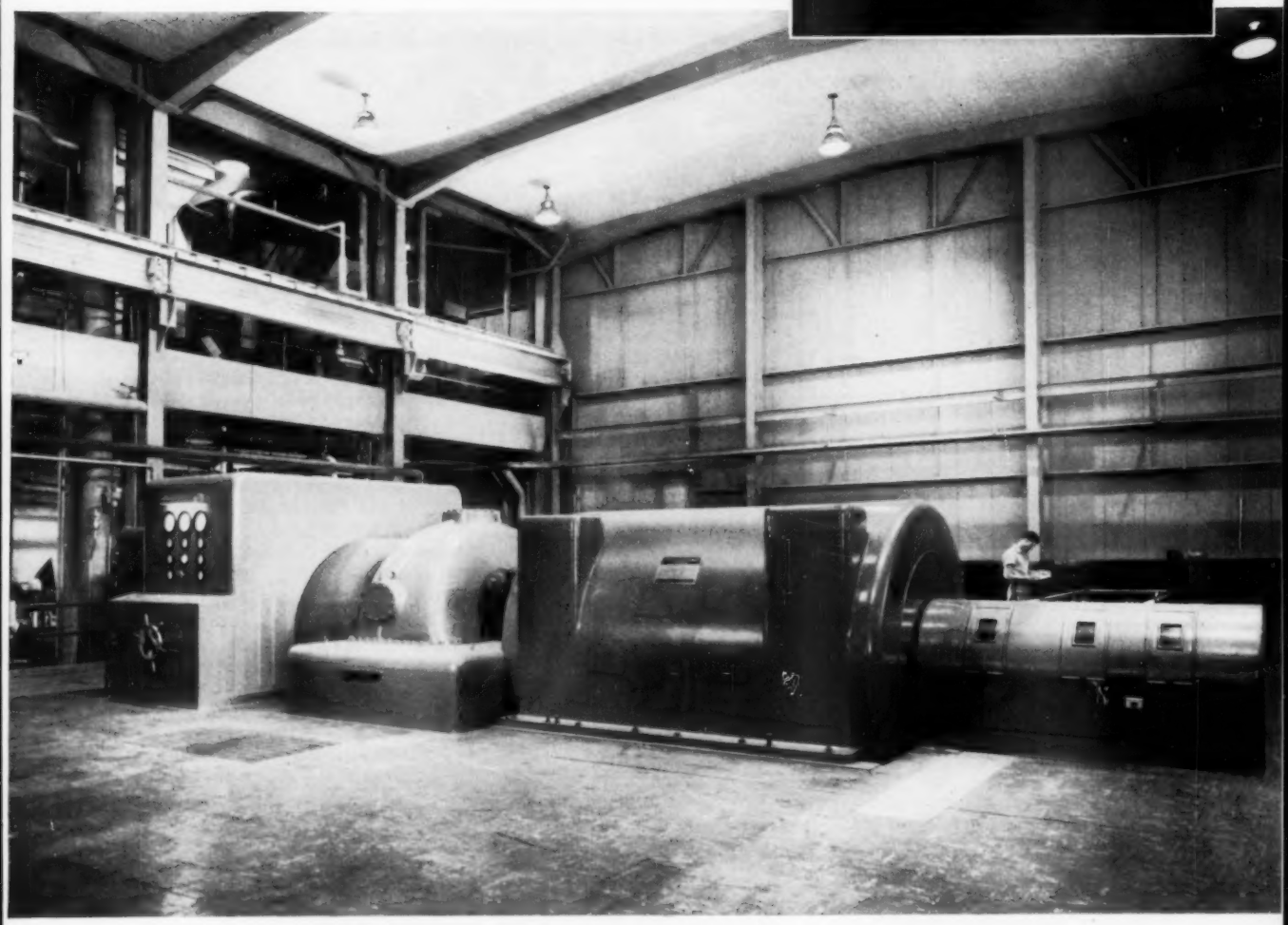
SPUTNIK-STIMULATED educational effort is the new Chicago Engineering Training Center just opened by Western Electric Co for the benefit of technical personnel. More than 2000 engineers a year will take 9-week courses in the Center and in two other graduate schools the company is establishing. Faculty members from four universities will combine forces with Western Electric researchers to present the latest developments in engineering, physics, chemistry and mathematics. Objective is to close the gap between scientific knowledge and engineering practice.

ASME's ANNUAL REPORT for 1957 shows a record income to the Society of $2,422,000, most of which was used to underwrite the production of technical journals, periodicals, codes and standards. During the year, 869 technical publications were issued. Membership stands at a new high of 52,012, including students.

AIR MOVING & Conditioning Association has announced the creation of a certified rating program. This means that the first big steps have been taken toward assuring a reliable means of judging the expected performance of air-moving equipment. To qualify for the AMCA Certified Rating, the manufacturer's product must meet certain specific conditions prescribed by the Association. AMCA was formed in 1956 by the merger of the National Assn of Fan Manufacturers, the Power Fan Manufacturers Assn, and the Industrial Unit Heater Assn.

Henderson, Ky., selects a third

DE LAVAL
TURBINE
GENERATOR



In 1950,...
two De Laval 5,000 kw multi-stage turbine generators were installed in the central station of Henderson, Kentucky. These units operated so dependably that the City of Henderson ordered a new, larger De Laval turbine generator to meet their increased power requirements.

Put on the line in 1956,...
this 12,650 kw De Laval machine is an AIEE-ASME Preferred Standard Unit. It operates at 600 psig and 825F; the turbine speed is 3,600 rpm.

De Laval multi-stage turbines are rugged in construction, economical to run. Transmission of power may be either direct or through speed reducing gears. De Laval multi-stage steam turbines are available for all services, including operation at the high pressures, high temperatures employed in steam plants of the latest design. Units are built in sizes up to 25,000 hp.

DE LAVAL *Turbine Generators*

DE LAVAL STEAM TURBINE COMPANY
816 Nottingham Way, Trenton 2, New Jersey

DL-980

WHAT THEY TELL US

▶ **WHO'S GOT A PROBLEM?** Recent batch of letters to and from readers here and there over the country furnishes a good cross-section of the problems now current in power engineering. Here's a list of what power engineers consider to be their most pressing problems:

Rehabilitation of electrical distribution system
New construction (quite a few have it)
Training programs (many have it)
Materials for h-p h-t boilers
Control of variable speed d-c motors
Water treatment
D-c to a-c conversion
Providing clean, dry compressed air
Lower maintenance costs
Developing proper maintenance for new numerically controlled machine tools

One reader, chief engineer of a manufacturing company in Ohio, outlined his most pressing problem as follows:

> Holes plug up on the boiler feed line inside the boiler, but the feed line stays clear, both inside and outside. Holes build up with a scale, but not loose scale. Holes are on the top side of pipe, with one in end at bottom.

Does this sound familiar to anybody, and if so what's the answer?

▶ **MORE ON PROCESSING FLY ASH** comes in, from Edward H. D. Gibbs, a vice president of Heyl & Patterson. Gibbs takes up our recent comment that, as far as we know, producing a sintered material from fly ash is not commercially feasible.

It seems that Heyl & Patterson have been interested in the possibility of sintered fly ash and have been carrying on a research program. Gibbs tells us:

> We have gained considerable information in the processing of fly ash to obtain acceptable lightweight aggregate. We have performed tests on fly ash from stations of several power companies, and all of the laboratory sintered fly ash we have produced meets all of the ASTM specifications for lightweight aggregates. Our work in this field has put us in a position to design and construct fly ash sintering plants using our own traveling grate-type sintering machine.
>
> On the basis of a six-day work week at 24 hours a day, 400 TPD plant, handling fly ash with sufficient carbon so that additional fuel is not required, the operating cost would not exceed $1 per cu yd of sintered material produced. This includes labor, power, ignition gas, maintenance, replacement parts and a binder if required. This figure is based on handling the fly ash from customer's silo through the plant to an adjacent storage area. It does not include any charge for the fly ash or transportation, and we do not consider amortization of the plant, since we have found that there is no set pattern for plant amortization.
>
> Although an actual installation has not been built, we strongly believe that a fly ash sintering plant would be commercially feasible in localities where there is a demand for lightweight aggregates.

▶ **NEED** for the availability of data on compressed cylinder gas is brought into the open by N. C. Stratton, chemical engineer with Gilbert Associates in Reading, Penna. We had sent Stratton copies of two POWER ENGINEERING articles relating to hydrogen-cooled machines. Stratton replies:

> Thank you for the copies of the articles, How to Use Dry Ice in CO_2 Purging Hydrogen-Cooled Generators and Design of Purging Systems for Hydrogen-Cooled Electric Machines. These, some manufacturers' literature such as that circulated by Dry Ice Converter Corp, Tulsa, Oklahoma, and word-of-mouth information passed on by a representative of the Pure Carbonic Co, Division of Air Reduction Co, complete our limited store of information on this subject.
>
> I have long lamented the fact that no comprehensive cylinder gas handbook exists. There is a definite need for such a handbook covering the compressed gases and yielding information similar to that published by the Chlorine Institute and chlorine manufacturers. Representatives of the compressed gas industry have indicated that they do not know of any comprehensive reference of this kind and they, too, feel that such a reference would be valuable. The Matheson Co, Inc, East Rutherford, N. J. and Joliet, Ill., publish a gas data book which consists of a number of helpful but incomplete data sheets.
>
> The marketing situation also has a bearing on this problem, and plant location is important. Consider the occasional purchase of an appreciable quantity of carbon dioxide at a given point. Out of three possible suppliers, one might be able to furnish only cylinder gas, a second would offer dry ice, and a third might have refrigerated tanker-trucks of liquid carbon dioxide passing the site at regular intervals and available as a source of supply. This immediately complicates the situation and each installation becomes a specific problem in itself which must be investigated with both equipment manufacturers and suppliers.
>
> It appears that here is a field for a manufacturers' association which could do a lot of good work, as exemplified by the Chlorine Institute. Apparently the competitive situation has prevented such action to date.

▶ **THREE YEARS** of experimentation and the solution of 150 complex engineering design problems have convinced Richard H. Gherst, power engineer with United Engineers & Constructors, Philadelphia, that digital computers are great labor-savers. For solution of average piping problems, for instance, Gherst estimates a money-saving ratio of about 3.5:1 in favor of the computer. Solving the average piping problem manually costs about $350, Gherst says, compared to $100 for answers to a computer-solved problem. He concludes:

> There seems no doubt that computer use will become standard operating procedure for pipe-stress analysis.

▶ **PROPER CARD** filing system for power plant records can be a problem. Paul N. Garay, whose recent series on planning for operation of the newly built plant included a chapter on How To Set Up Operating Records (POWER ENGINEERING, October, 1957, pages 86–87) writes to suggest a new idea which seems to have possibilities. It's based on Royal McBee Corp's KS371N Keysort cards. Garay sends this description:

> Each card has 78 available holes on its edge, to each of which a meaning can be assigned. This makes it easy to sort data in many different ways. A hand-operated punch is used to notch each card through the holes pertaining to data on that card. To do the sorting, a selector rod is passed through all the cards at the hole standing for the kind of information desired. Lifting the selector raises the cards and allows those notched at the top to drop. These can then be sorted for other points, or they can be returned to the whole and a new sorting made. Such a punched-card system makes possible rapid examination of data, for any combination of factors, since each sorting can be done in only a few seconds.

Maintenance and Steam Traps

. . . there's a relationship that goes far beyond trap maintenance alone

Good traps and good trapping have a greater effect on your maintenance costs than does trap maintenance itself. By that we mean that the right traps, properly selected and installed, and with the benefits of a preventive maintenance program, will save far more maintenance dollars than they will cost.

Under the pressure of spiralling maintenance costs, this thought becomes mighty important. Let's take a look at what it involves:

Proper Selection of Steam Traps

1. Be sure it's the right type of trap.

2. Be sure it's sized right and is for the correct operating pressure.

3. Be sure it's first rate in design and construction.

Proper Installation of Steam Traps

1. Install them so they are accessible for inspection and maintenance.

2. Install a test valve.

3. Use a union or unions.

4. Use a shutoff valve or valves.

5. Use a strainer ahead of the trap if dirt conditions are bad.

6. Use a by-pass only where continuity of service is imperative.

7. Standardize inlet and outlet connections.

Preventive Maintenance Program

1. Test trap regularly for proper operation. (Trap size, operating pressure and importance determine frequency.)

2. Inspect internal mechanism at least once a year.

You Get Indirect Benefits As Well

The direct benefits of the plan outlined are pretty obvious — good traps, properly selected, require less maintenance . . . testing and inspection prevents troubles that lead to maintenance.

However, this plan provides indirect benefits which reduce maintenance in other parts of the plant as well:

Good traps save steam and reduce the load (and consequently maintenance) on fuel handling and burning equipment and on ash handling equipment.

Good traps protect the system by eliminating water hammer and preventing the damage it can do.

Good traps discharge carbon dioxide before it can go into solution to form corrosive carbonic acid — less corrosion, less maintenance.

Good traps increase production to reduce the length of time equipment must operate or reduce the amount of equipment needed . . . either way maintenance is reduced.

How to Go About It (The Sales Pitch)

We admit we're prejudiced, but we don't think there is any better way to select steam traps than with the help of the 44 page Armstrong Steam Trap Book. Here in a single source is specific data on the selection and sizing of traps, how to install them for best results, and how to maintain them most economically.

The Steam Trap Book will also give you full information on the design and construction of Armstrong Inverted Bucket Steam Traps that offer these important maintenance-reducing advantages:

1. Armstrong Traps are dependable.

2. Armstrong Traps require no adjustments — go from full load to zero load automatically.

3. Armstrong Traps are self-scrubbing—ordinary dirt conditions can't hurt them.

4. Armstrong Traps have long-life parts — valve and seat are heat treated chrome steel — lever assembly and bucket are stainless steel.

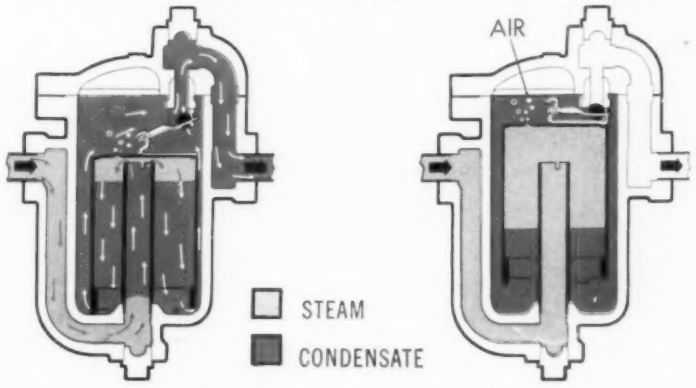
5. Armstrong Traps have water sealed valves to minimize wire drawing and erosion.

Ask for your copy of the Steam Trap Book—there is no obligation. Then test Armstrong Trapping. If you are not completely satisfied with the results, you can return the traps for a full refund of the purchase price. You can't lose much that way. Call your local Armstrong Representative or Distributor, or write

Armstrong Machine Works
8104 Maple Street
Three Rivers, Michigan

ARMSTRONG STEAM TRAPS

HERE'S THE STEAM TRAP DESIGN
THAT CAN REDUCE YOUR MAINTENANCE PROBLEMS



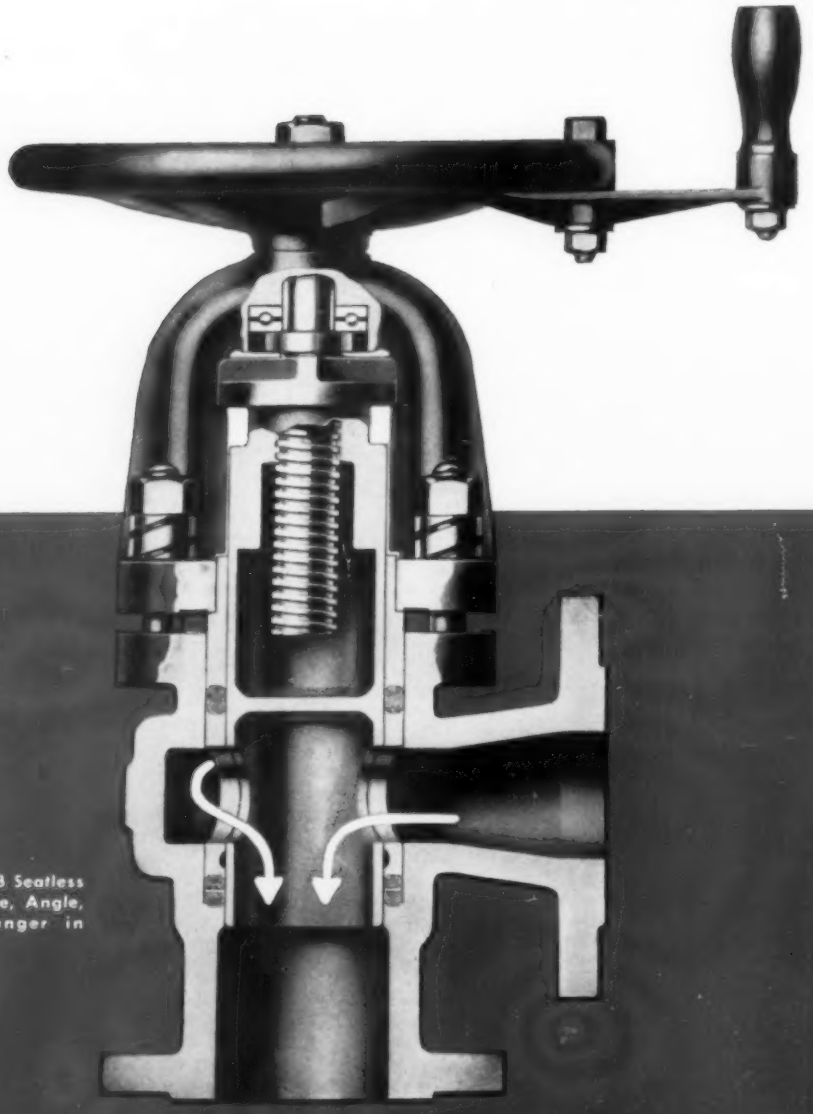
Trap open. Condensate entering trap has caused bucket to lose buoyancy. Weight of bucket times leverage pulls valve open. Air is discharged along with condensate.

Trap closed. Steam has floated inverted bucket; valve is held tightly closed by system pressure. Air entering trap passes through bucket vent and accumulates at top of trap.

For more data circle 504 on Post Card

seatless

. . . for



Yarway Type B Seatless Blow-Off Valve, Angle, showing plunger in open position.

YARWAY

trouble-free blow-down service

YARWAY SEATLESS BLOW-OFF VALVES

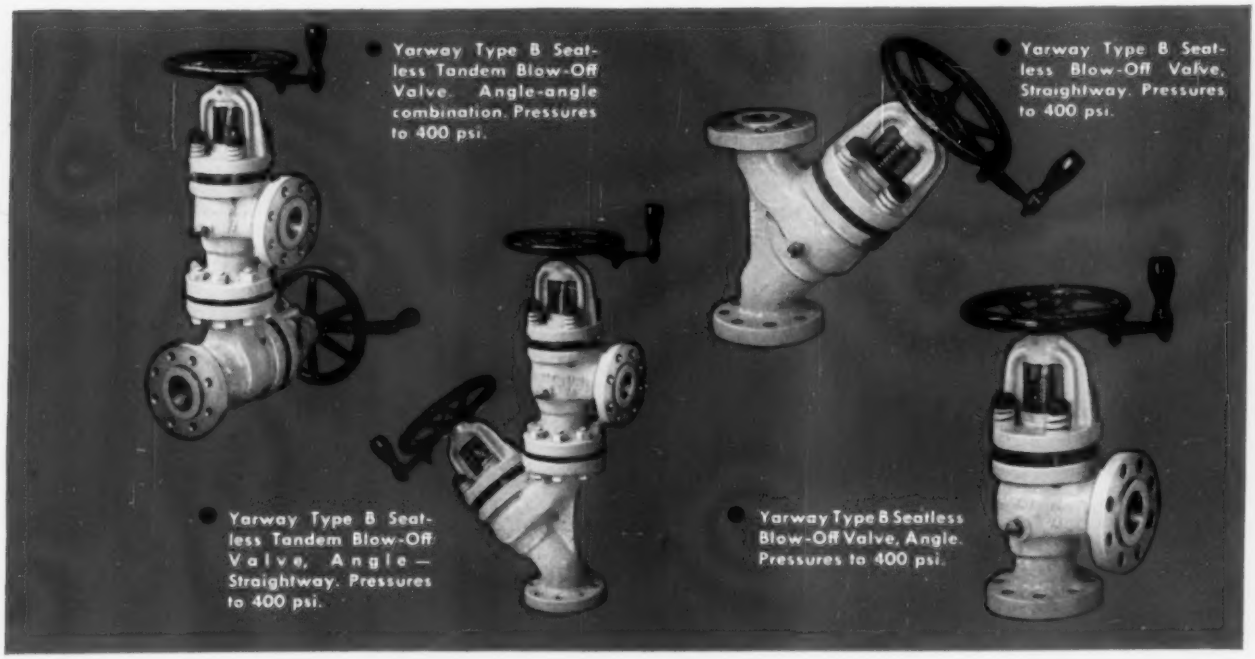
"Trouble preventers" is what YARWAY Seatless Blow-Off Valves are often called because they eliminate one of the commonest sources of trouble in low and medium pressure boiler blow-down service. *There is NO SEAT to score, wear, clog or leak.*

YARWAY Seatless Blow-Off Valves feature a balanced, sliding, hollow plunger design that permits free and easy operation—full, unobstructed flow.

More than 16,000 boiler plants today use YARWAY *Blow-Off Valves.*

YARWAY Bulletin B-426 shows all the latest types and features of YARWAY Seatless Blow-Off Valves. If you operate your boilers up to 400 psi, you'll find a copy helpful. For higher pressures, ask for Bulletin B-434. Write today.

YARNALL-WARING COMPANY
100 Mermaid Ave., Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

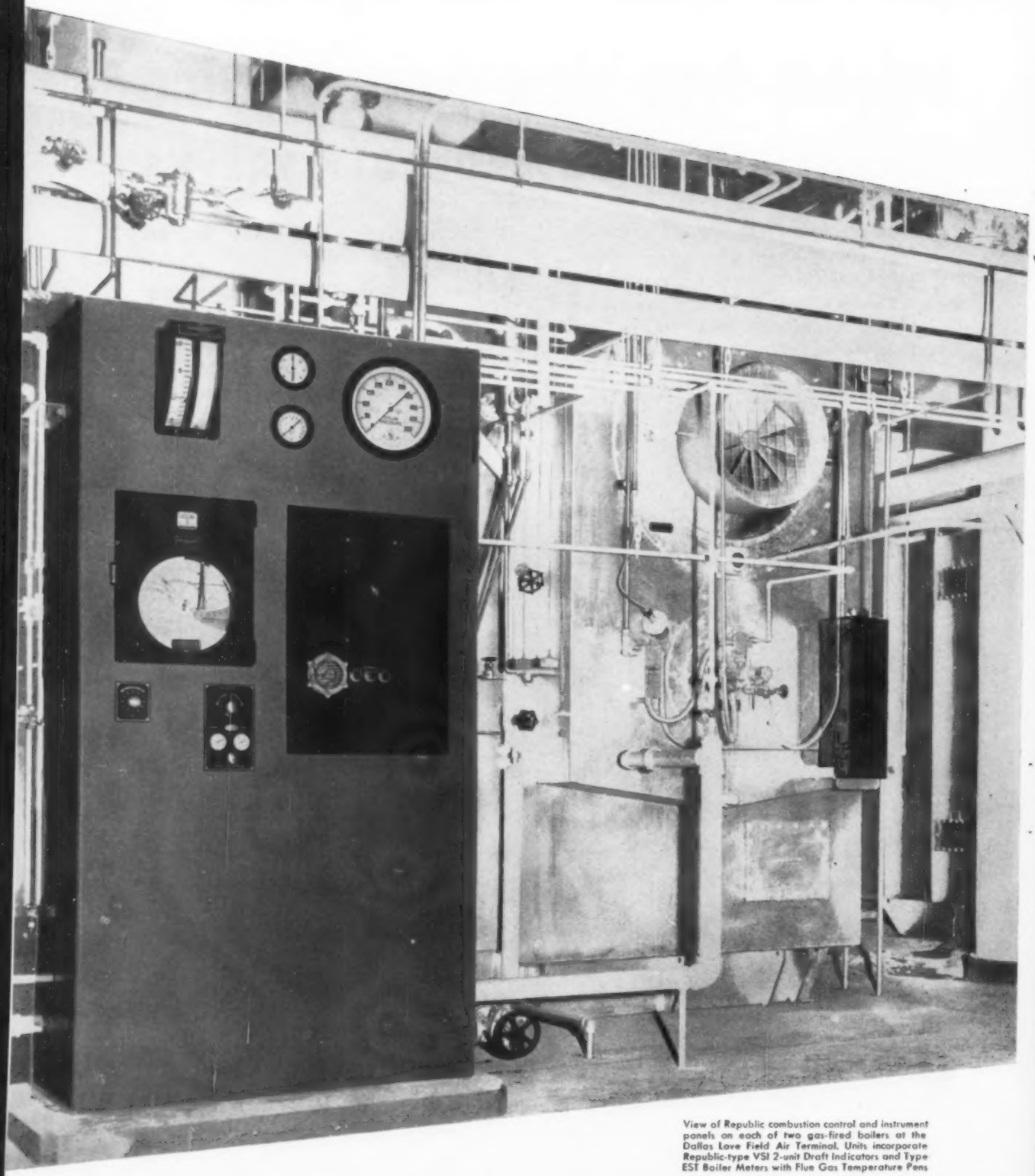

Yarway Type B Seatless Tandem Blow-Off Valve. Angle-angle combination. Pressures to 400 psi.
Yarway Type B Seatless Blow-Off Valve, Straightway. Pressures to 400 psi.
Yarway Type B Seatless Tandem Blow-Off Valve, Angle—Straightway. Pressures to 400 psi.
Yarway Type B Seatless Blow-Off Valve, Angle. Pressures to 400 psi.

— *blow-off valves*

For more data circle 505 on Post Card

ANOTHER REPUBLIC ACHIEVEMENT!

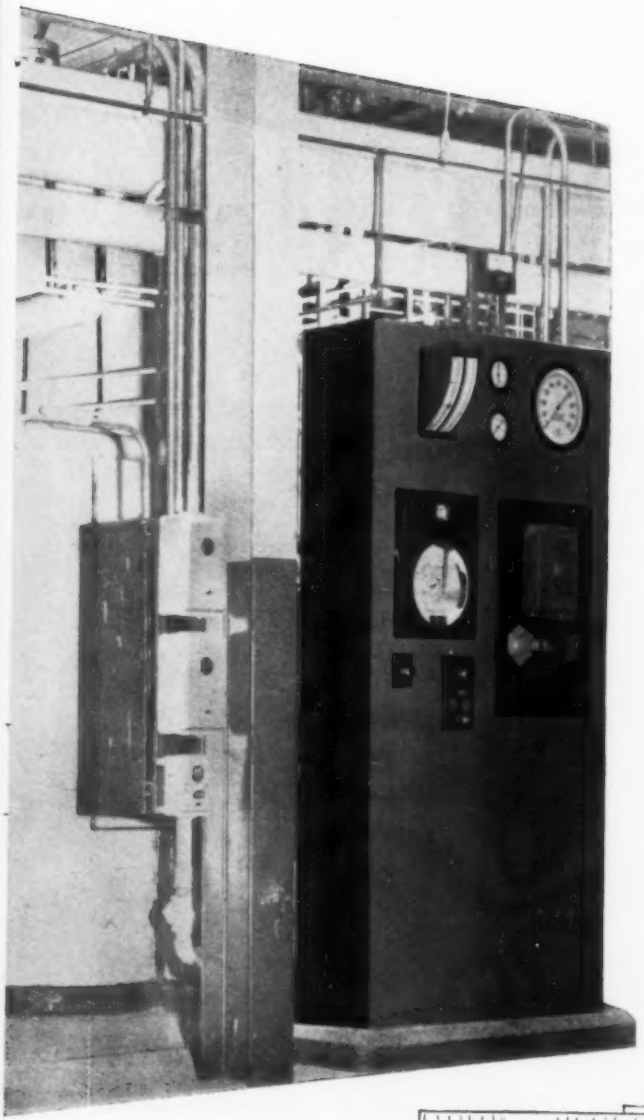
Republic Controls on Package



View of Republic combustion control and instrument panels on each of two gas-fired boilers at the Dallas Love Field Air Terminal. Units incorporate Republic-type VSI 2-unit Draft Indicators and Type EST Boiler Meters with Flue Gas Temperature Pens

Boilers Regulate "Indoor Weather"

...at Dallas' new Love Field Air Terminal



Complete Republic combustion control includes such features as on/off and modulating operation, instrumentation and flame failure control. This type of system operates two 15,000 lbs/hr package boilers, which supply 235 psi steam to centrifugal refrigeration compressors for the Terminal's air conditioning.

Republic's modern control designs are right at home in this $8,000,000 air terminal, which also features such innovations as touch control automatic doors, two-way moving sidewalks and carefully regulated "indoor weather". The new Love Field Air Terminal is truly one of the most modern in America.

Advanced-design combustion controls, based on Republic's experience in plants of all sizes—from package boiler installations to large central station units—are your best guarantee of premium performance from your major equipment. A Republic engineer is ready to help with your instrument and control planning. Republic sales offices are located in principal cities throughout the U.S. and Canada.

REPUBLIC
FLOW METERS CO.

Subsidiary of ROCKWELL MANUFACTURING COMPANY

2240 DIVERSEY PARKWAY • CHICAGO 47, ILL.
In Canada:
REPUBLIC FLOW METERS CANADA, LTD. TORONTO

Manufacturers of electronic and pneumatic instrument and control systems for utility, process and industrial applications.

DALLAS LOVE FIELD AIR TERMINAL

Associated Architects: Broad & Nelson; Jack Corgan, Dallas
Engineers: Forrest & Cotton, Dallas
Combustion Controls & Instruments: Republic Flow Meters Co., Chicago

THE CROSS COMPANY—Fraser, Michigan

Installed at this new ultra-modern plant are two 12-million BTU capacity C-E Hot Water Boilers. When this pioneer producer of automation equipment studied their heating requirements, they calculated that this system would provide the lowest fuel and maintenance costs. Their actual winter operating experience proved the soundness of this decision.

CONVAIR-ASTRONAUTICS—San Diego, California

When this division of the General Dynamics Corporation determined that more space was needed for their Atlas Intercontinental Ballistic Missile project, this new center for research, development, manufacturing, and primary testing of the Atlas was decided upon. Installed in this center of space flight research will be two 30-million BTU C-E Hot Water Boilers.

HIGH TEMPERATURE

ADVANTAGES

—of high temperature water:

1. Higher available heat—many times that of steam at the same pressure.
2. Closer control of temperature.
3. Lower heat loss . . . unused heat returns to the boiler . . . no condensate return lines.
4. No elaborate feedwater treatment . . . make-up requirements are exceptionally low.
5. Steam traps not required . . . trap problems and expense are eliminated.
6. No blowdown losses . . . no safety valve vent losses . . . no condensate losses.

—of the C-E Hot Water Boiler:

1. Complete control of circulation in system and boiler.
2. No separate boiler pump needed . . . pressure loss is low.
3. Pressurized operation with oil or gas means no induced draft fan.
4. Single-pass design—no baffles—means cleaner boiler and lower draft loss.
5. Controlled, positive circulation permits more efficient arrangement of heating surfaces.
6. Any fuel—oil, gas, coal, or any combination of fuels.
7. Gas-tight, welded steel casing.
8. Fewer headers, all of which are easily accessible.

COMBUSTION

Combustion Engineering Building

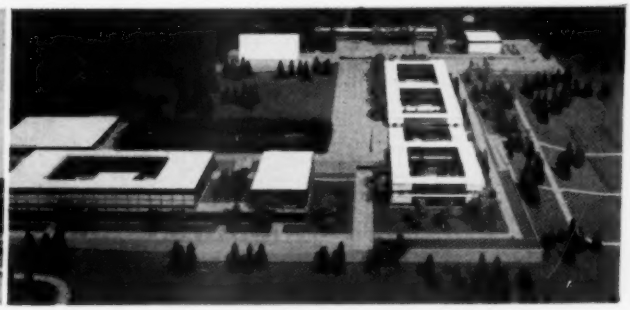
CANADA: COMBUSTION ENGINEERING-

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS;

RIVERVIEW COMMUNITY HIGH SCHOOL—Riverview, Michigan

To keep pace with the expanding need for more educational facilities, Riverview, Michigan has recently finished this fine, modern high school. Its heating requirements are met by two 10-million BTU C-E La Mont Controlled Circulation Hot Water Boilers.

U.S. AIR FORCE ACADEMY—Colorado Springs, Colorado



Typical of our Air Force's widespread acceptance of high temperature water for various of their installations is the selection of five C-E Hot Water Boilers for their new academy. These units will furnish heat for living, academic, and service areas here.

WATER today's new idea in large-space heating

In such diverse applications as industrials, large educational institutions, and military bases, high temperature water is finding rapidly increasing acceptance as an ideal means of heating large areas.

A big factor in bringing this trend about is The C-E La Mont Controlled Circulation Hot Water Boiler. Using the same principle as that applied by C-E in many of the country's largest utility boilers, this new boiler provides a degree of temperature control that makes it the most attractive method of heating in many cases. With a wide range of capacities – from 10 to 300 million Btu's – these boilers operate at water pressures up to 500 psi and temperatures to 470F, or higher. Depending upon local conditions, a C-E Hot Water Boiler can save from 10 to 20 per cent in maintenance and operating costs.

The smaller capacity Hot Water Boilers are completely shop assembled, while the intermediate and large units are shipped in varying stages of assembly. This C-E practice greatly reduces erection costs.

So, if you are in the market for boilers, either for space heating or process requirements, it may prove greatly to your advantage to investigate the use of high temperature water as your heat source. Because individual needs vary, both steam and hot water have their place. Our engineers will be pleased to discuss either method with you or your consultants –impartially and with no obligation.

For further details on high temperature water boilers by C-E write for our catalog HCC-2.

ENGINEERING

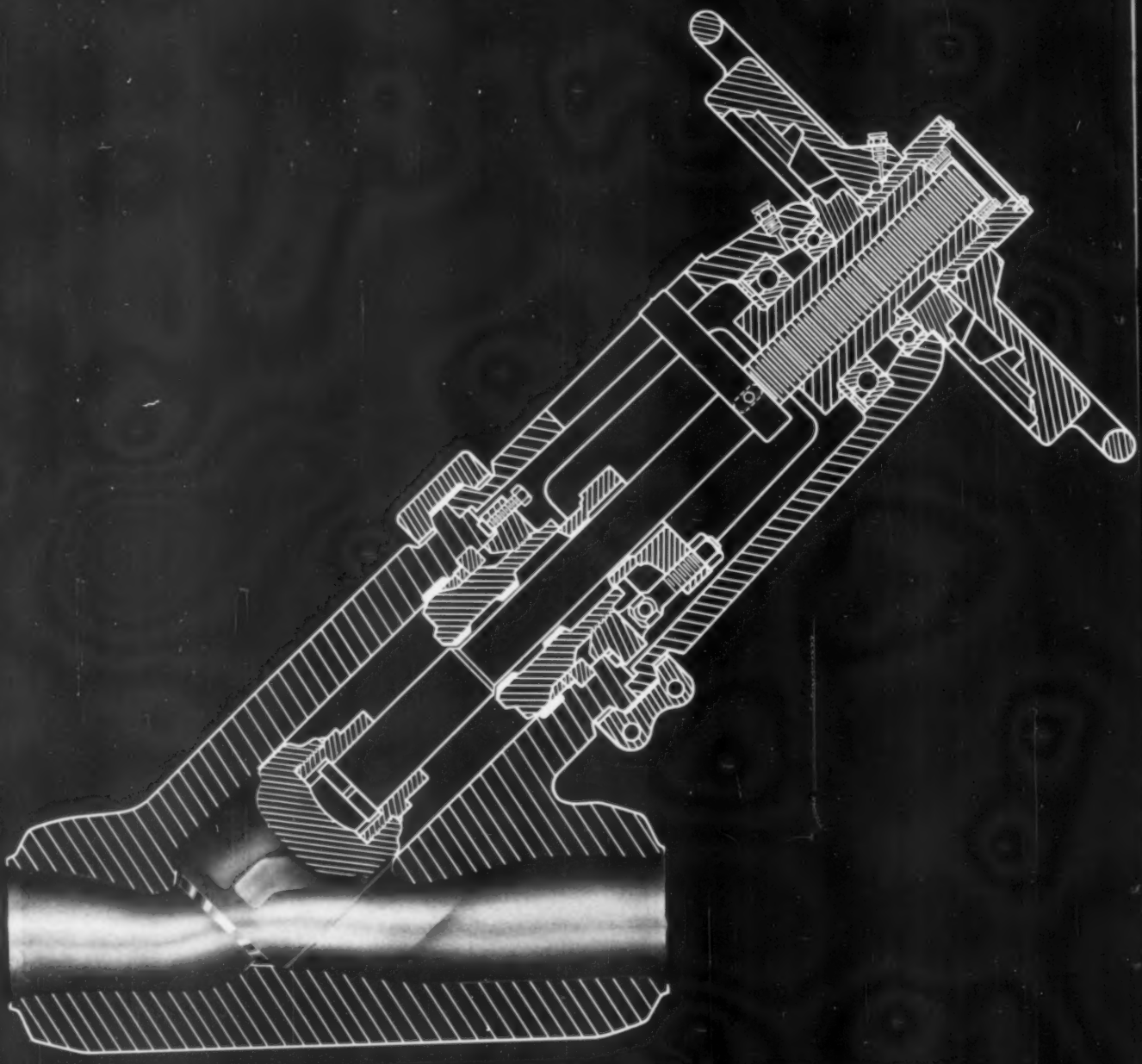
C-120

200 Madison Avenue, New York 16, N. Y.

SUPERHEATER LTD.

PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; SOIL PIPE

For more data circle 507 on Post Card



NEW EDWARD "FLITE-FLOW" VALVE

What's New from Edward Valves, Inc.

New Products . . . Problems and Solutions. . . Information on Steel Valves from Edward, Long-Time Leader in the Field!

New Flite-Flow* Valve Cuts Pressure Drop 70%

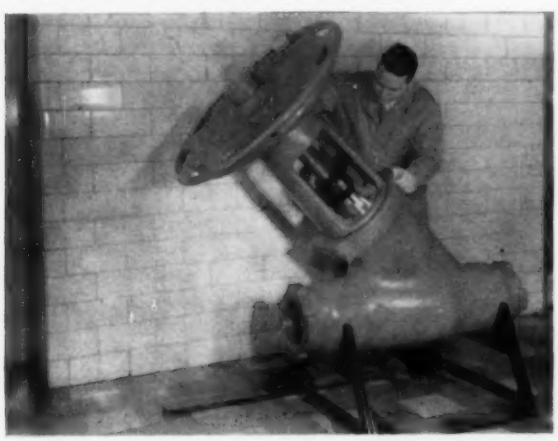
. . . yet provides full globe valve tightness and repairability

Through basic characteristics of its design, only a hard seat globe-type valve can be depended upon to give drop-tight shutoff under high-pressure, high-temperature conditions. But conventional globe valves also produce serious pressure-drop problems—which intensify in the trend toward larger-capacity, higher-pressure plants with their higher-velocity flow rates.

Briefly stated, this was the problem given to Edward engineers. In their continuing program of valve development, these men had singled out turbulence in the flow path as a key area for study. They charted the effects of re-shaping flow passages . . . of shifting valve seat location . . . of *pre*-shaping the flow as it approaches the seat.

Low turbulence factor

All tests confirmed that total pressure drop was least when turbulence was minimized in the three most critical areas: ahead of, at *and beyond the seat*. In the final design, flow approaching the seat is pre-shaped to provide a special "squirting action" which carries the fluid smoothly across the seat. The downstream side of the passage is shaped to receive this flow and send it on with a minimum of eddy and turbulence.



The net result of years of research and development, Flite-Flow is available in sizes 10" and larger.

The result is Flite-Flow, a globe valve with drop-tight shutoff *and* negligible pressure drop, as shown in the tables below:

FEEDWATER SERVICE

In 500-F, 3000-psi feedwater service on a 1,500,000 lb/hr unit, the following performance of 12-inch valves has been recorded:

Ordinary globe valve ... 10-15 lb drop
EDWARD FLITE-FLOW VALVE ... 2.1 lb drop
Good gate valve ... 1.0 lb drop

STEAM SERVICE

In 1050-F, 1900-psi steam service at 800,000 lb/hr through a 12-inch valve, the following performance has been recorded:

Ordinary globe valve...64 lb drop
EDWARD FLITE-FLOW VALVE ... 11 lb drop
Good gate valve ... 2 lb drop

OTHER IMPORTANT FLITE-FLOW FEATURES:

- RESISTANCE TO THERMAL DIFFERENTIALS —a real design and metallurgical achievement.
- REPAIRABILITY OF SEATING SURFACES —while valve is in the line.
- PIPING VERSATILITY —fits any piping plan. Unique design assures accurate guiding of disk whether stem extends up, down or horizontally.
- IMPROVED OPERATING MECHANISMS —manual, pneumatic, electric.
- INTEGRAL SEAT CONSTRUCTION —inlaid stellite seat, machined and lapped in same set-up as body bore for perfect alignment.

EDWARD VALVES, INC.

Subsidiary of ROCKWELL MANUFACTURING COMPANY

1202 West 145th Street, East Chicago, Indiana

Represented in Canada by
LYTLE ENGINEERING SPECIALTIES, LTD., 360 Notre Dame St., W. Montreal 1, Que.

Edward builds a complete line of forged and cast steel valves from ⅛" to 18"; in globe and angle stop, gate, non-return, check, blow-off, stop-check, relief, hydraulic, instrument, gage and special designs; for pressures up to 7500 psi; with pressure-seal, bolted, union or welded bonnets; with screwed, welding or flanged ends.

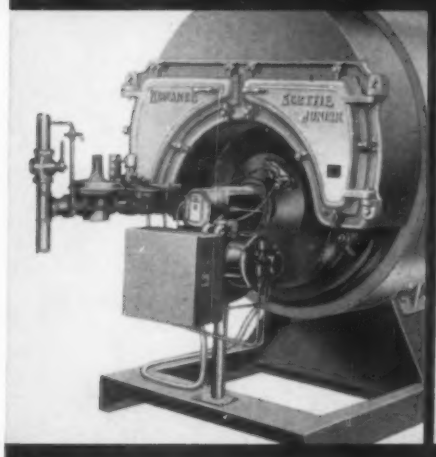
*T.M. Reg. U.S. Pat. Off.

For more data circle 508 on Post Card

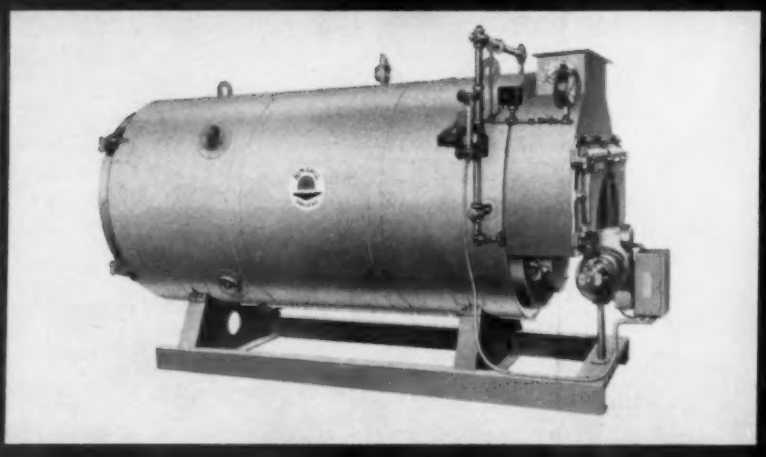
NEW!

KEWANEE®

FORCED-DRAFT



GAS-OIL COMBINATION FIRING for the new Kewanee package units is provided by this Kewanee burner designed for quick fuel change-over without adjustments.



NEW 606,000 TO 3,060,000 Btuh CAPACITIES: Kewanee Scottie Jr. low pressure boiler with Kewanee burner. Firing rate is balanced with boiler capacity. Oil burner (shown) is high pressure, twin nozzle type. Gas burner is equipped for either natural or LP gas.

another KEWANEE®

quality product . . .

proven in

the field

Now . . . Kewanee provides 8 popular high pressure packages, 18 to 92 horsepower . . . 8 low pressure packages, 606,000 to 3,060,000 Btuh.

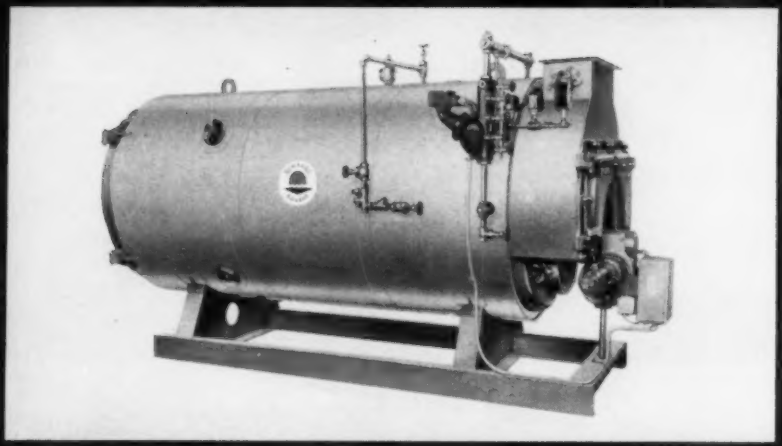
Forced-draft firing keeps combustion air supply constant, regardless of location or atmospheric conditions. Only a vent pipe is needed. The long, low lines of today's buildings are not violated by a costly, unsightly stack. Nor does the boiler room ceiling need to be higher than a standard 8 feet.

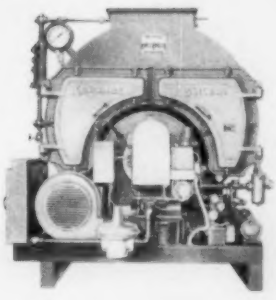
Fuel flexibility is provided by Kewanee burners for oil, gas or gas-oil combination firing. On combination units, fuel changeover is simple and fast . . . can be handled by automatic controls if desired.

Traditional Kewanee quality is engineered into the complete unit. Reserve strength is built into

18 TO 92 HORSEPOWER

PACKAGE UNITS





NEW 18 TO 92 HP CAPACITIES: For 125-150 swp or high temperature water above 250° F. Kewanee Scottie Jr. high pressure boiler with a Kewanee burner for oil (shown) or gas. Features include long gas travel, ample steam space, x-rayed and stress relieved welds.

OTHER LARGER KEWANEE BOILERS range up to 651 hp for high pressure . . . 21,855,000 Btuh for low pressure. Matching forced-draft burners are available for oil, gas and gas-oil combination firing.

all parts . . . moving parts are accurately machined to close tolerances. All features of design and construction are aimed at maximum dependability and long-range economy. Easy access is provided for boiler inspection and cleaning.

Kewanee factory-assembles the entire unit before shipping. The boiler is fitted with burner and controls at the factory, with controls housed in integral control panel. Boiler gages and controls are in place, as well as rear combustion chamber of high temperature refractory. Unit is shipped as a complete package—fire-tested if desired.

Send coupon at right for complete information. Clip it today and mail it to:

AMERICAN-STANDARD, KEWANEE BOILER DIVISION,
101 Franklin Street, Kewanee, Illinois.

American-Standard
KEWANEE BOILER DIVISION
101 Franklin Street • Kewanee, Illinois

KEWANEE 1958 1868 90th year

Please supply literature on the following Kewanee Boilers:

- ☐ low pressure
- ☐ high pressure
- ☐ new 18 to 92 h.p. packages
- ☐ all capacities

Name_____

Firm_____

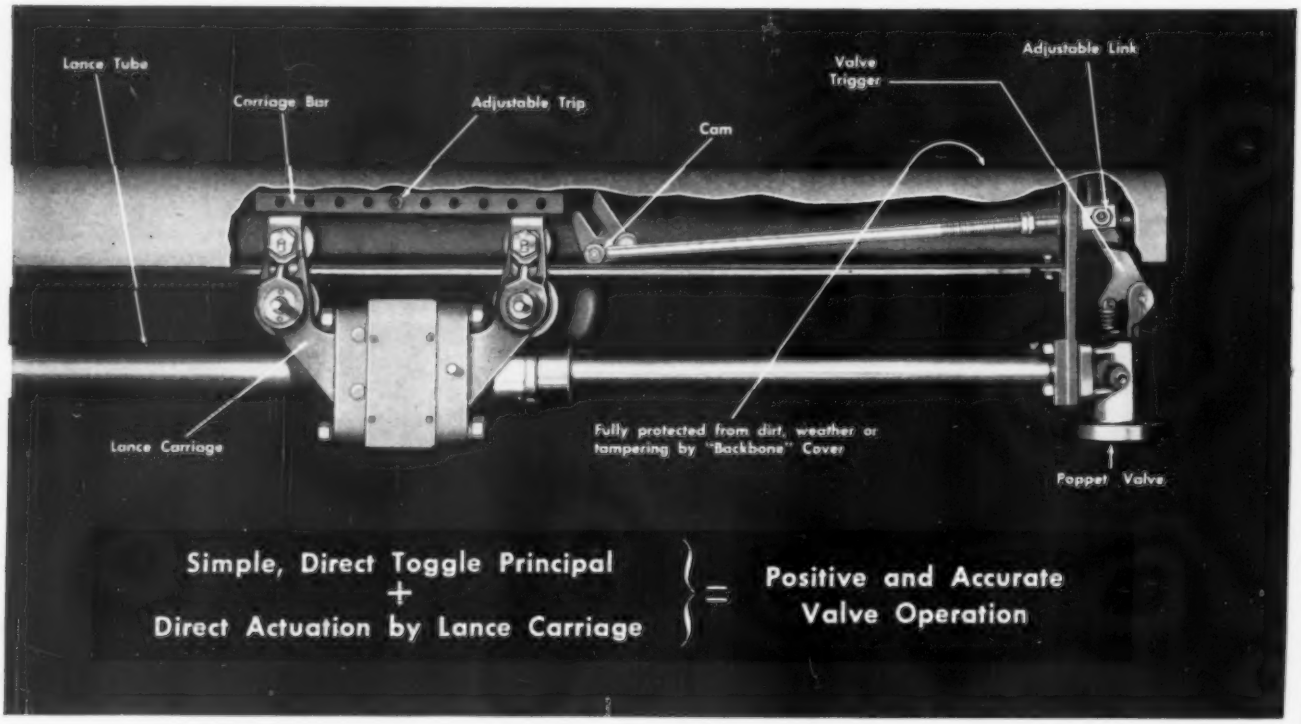
Street_____

City_____ Zone_____ State_____

AMERICAN-Standard
KEWANEE BOILER DIVISION

For more data circle 509 on Post Card

MECHANICALLY OPERATED



SERIES 300 IK—LONG RETRACTING BLOWER

OTHER ADVANTAGES OF SERIES 300 IK BLOWERS

- Backbone and Protective Cover
- Compact, Accessible Electric Power and Control Terminal Facilities
- Front End Single-Motor Drive
- Nozzle-Sweep-Every-Inch Cleaning Pattern
- Improved "Type A" Nozzle
- Positive Gear Carriage Drive
- Single Point Outboard Suspension
- Oversize Lance (Step-Tapered for Extra Long Travel)
- Auxiliary Carriages for Extra Long Travel
- Designed for Quick, Easy Servicing

No other blower gives you all these advantages.

DIAMOND POWER SPECIALTY CORP.

LANCASTER, OHIO

Diamond Specialty Limited, Windsor, Ontario

POPPET TYPE VALVE

(WITH ADJUSTABLE PRESSURE CONTROL)

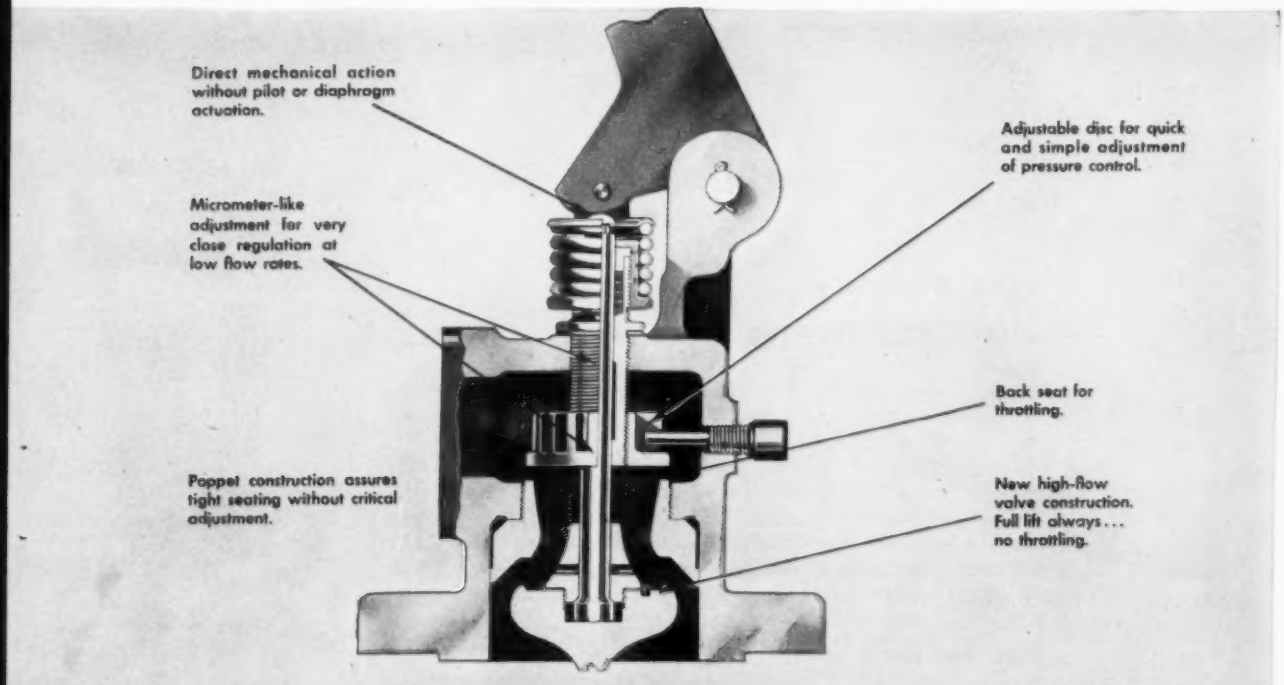
additional important features of the

New Diamond Series 300 IK
LONG RETRACTING BLOWER

This valve was adopted for the new Series 300 IK because long experience has proved it the most satisfactory of all designs for severe blower service. More than 300,000 of this basic design are in use on various Diamond Blowers and have established notable service records. A recent improvement is more streamlined flow contours that permit higher flow rates with less pressure drop.

The direct mechanical linkage for actuating the valve offers the advantages of greater reliability and safety . . . in addition to more accurate control. Numerous other important features of the Series 300 IK are listed at the bottom of the left hand page. These are the reasons why this blower is establishing a new standard of efficiency, economy and dependability in cleaning heating surfaces that require a long retracting blower.

Bulletin 2111AB tells much more about the Series 300 IK; ask your local Diamond office or write directly to Lancaster for a copy.


Direct mechanical action without pilot or diaphragm actuation.
Micrometer-like adjustment for very close regulation at low flow rates.
Poppet construction assures tight seating without critical adjustment.
Adjustable disc for quick and simple adjustment of pressure control.
Back seat for throttling.
New high-flow valve construction. Full lift always... no throttling.

FULL LIFT AND FULL OPENING OF VALVE AT ALL TIMES. No throttling at main seat. ALL throttling for pressure control is between back seat and adjustable disc.

7819

For more data circle 510 on Post Card

long-run power by Allis-Chalmers

If you specify "Allis-Chalmers motors or equal"

. . . remember that the "equal" is possible only in two respects: price and nameplate specifications. You can't match the *long-run power* of Allis-Chalmers motors.

Double-shielded bearings guarded against dirt and over-greasing . . . provision for elimination of moisture condensation . . . practically indestructible rotor design . . . more cooling surface . . . more iron and copper content — these are the features (with others) that make up long-run power. These are the features that give Allis-Chalmers motors "plus" performance that can't be equalled.

Find out more about the motors with long-run power from your A-C representative or distributor, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-5663

POWELL

world's largest family of valves

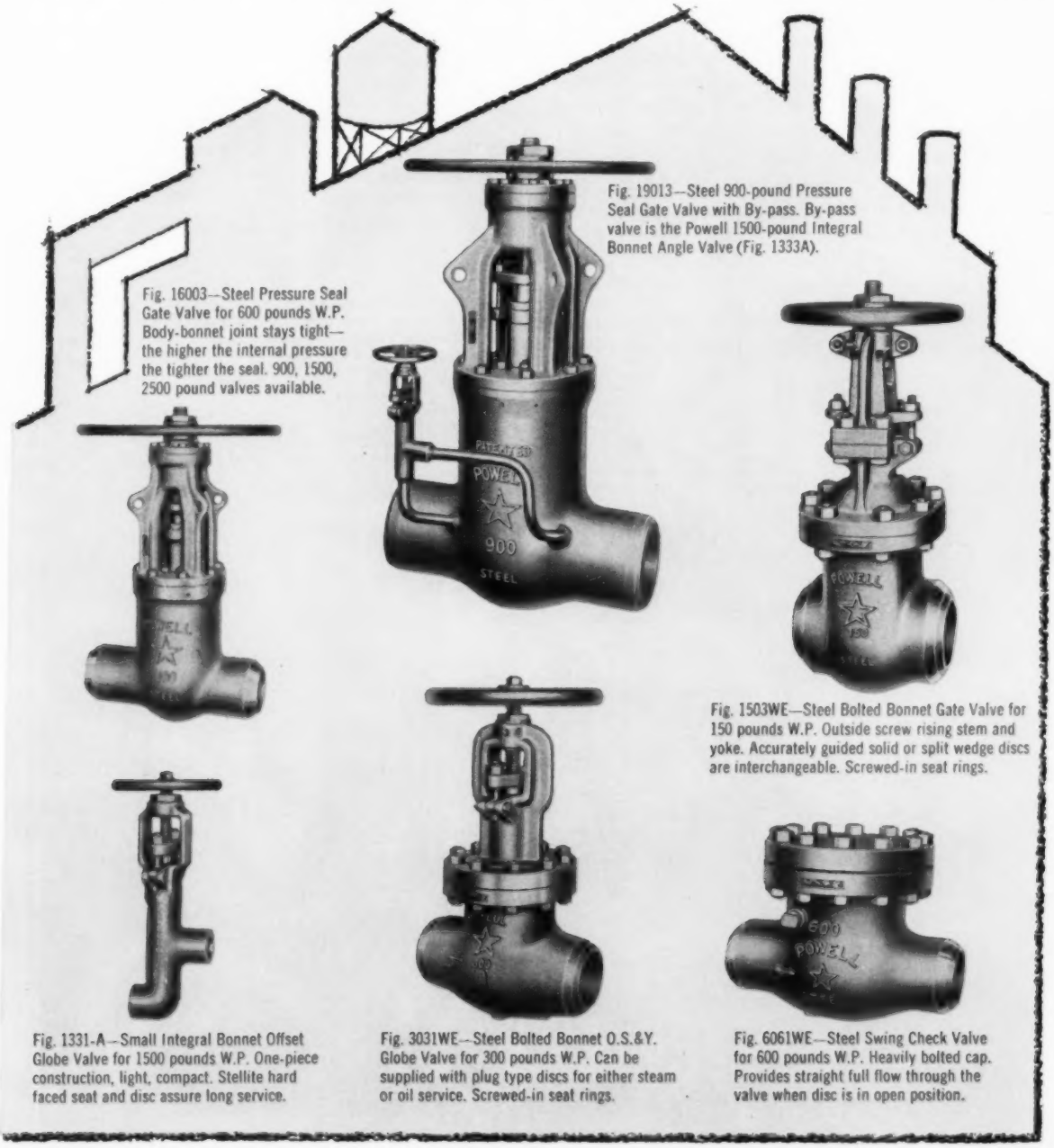


Fig. 19013—Steel 900-pound Pressure Seal Gate Valve with By-pass. By-pass valve is the Powell 1500-pound Integral Bonnet Angle Valve (Fig. 1333A).

Fig. 16003—Steel Pressure Seal Gate Valve for 600 pounds W.P. Body-bonnet joint stays tight—the higher the internal pressure the tighter the seal. 900, 1500, 2500 pound valves available.

Fig. 1503WE—Steel Bolted Bonnet Gate Valve for 150 pounds W.P. Outside screw rising stem and yoke. Accurately guided solid or split wedge discs are interchangeable. Screwed-in seat rings.

Fig. 1331-A—Small Integral Bonnet Offset Globe Valve for 1500 pounds W.P. One-piece construction, light, compact. Stellite hard faced seat and disc assure long service.

Fig. 3031WE—Steel Bolted Bonnet O.S.&Y. Globe Valve for 300 pounds W.P. Can be supplied with plug type discs for either steam or oil service. Screwed-in seat rings.

Fig. 6061WE—Steel Swing Check Valve for 600 pounds W.P. Heavily bolted cap. Provides straight full flow through the valve when disc is in open position.

For every flow control problem Powell offers more kinds or types, available in the largest variety of metals and alloys to handle every flow control requirement. Powell distributors are located in all principal cities and maintain inventories to fill almost any need. For special engineering problems, write direct to:

THE WM. POWELL COMPANY • *Dependable Valves Since 1846* • **Cincinnati 22, Ohio**

For more data circle 512 on Post Card

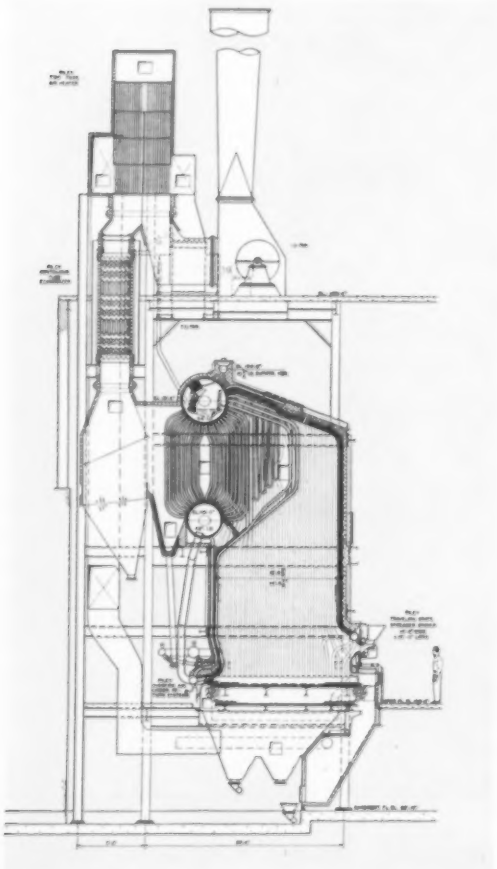
PRIZE WINNING RILEY BOILERS

These Riley Boilers played important roles in winning awards for outstanding modernization of steam generating facilities in national contests conducted in recent years by a prominent publisher for the power industry. Each design was required to meet exacting specifications for size and arrangement in order to fit into restricted building space. Each has produced high fuel economies and high boiler efficiencies to earn at least a 20% annual return on the original investment.

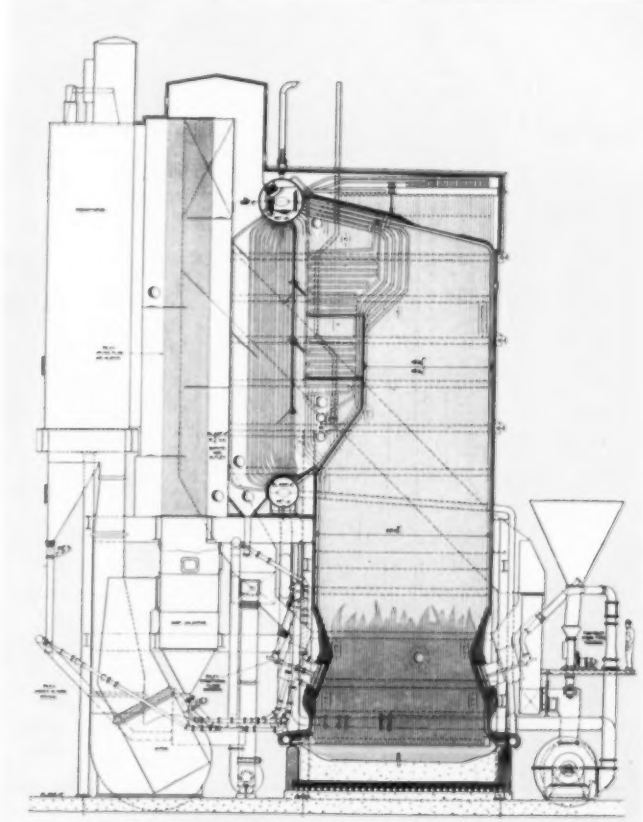
Hundreds of Riley industrial boiler installations are also paying similar bonus dividends in yearly net efficiency, dependability and in continuous, uninterrupted operation.

New additions to engineering facilities at Worcester and expanded production facilities at Riley's Pennsylvania plant will now speed delivery of Riley industrial type boilers from 50,000 lbs/hr and up. *Riley Stoker Corporation, Worcester, Mass.*

Representatives in Buffalo, Chicago, Cleveland, Detroit, New Orleans, New York, Philadelphia, Pittsburgh, Atlanta, Charlotte, Cincinnati, Houston, Kansas City, Los Angeles, Portland, St. Louis, St. Paul, Salt Lake City, San Francisco and Seattle.

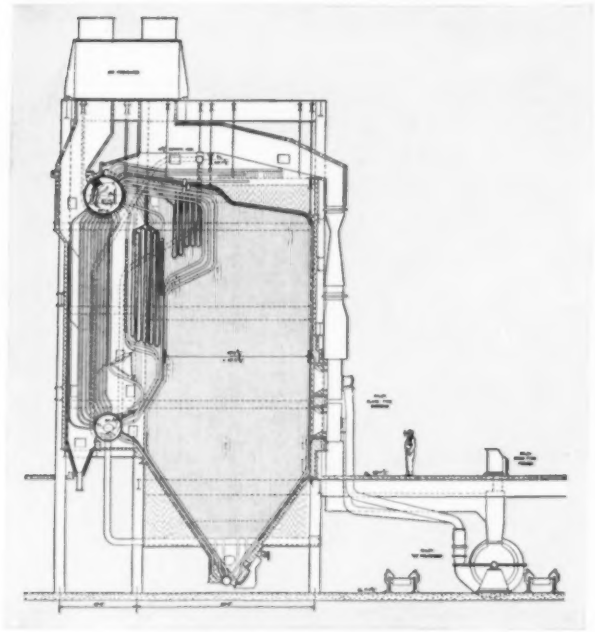


Garlock Packing Co., Palmyra, New York
100,000 lbs/hr Riley Single Pass Boiler Fired by Riley Traveling Grate Spreader Stoker. 425 psig., 600 F. Cinder Reinjection.

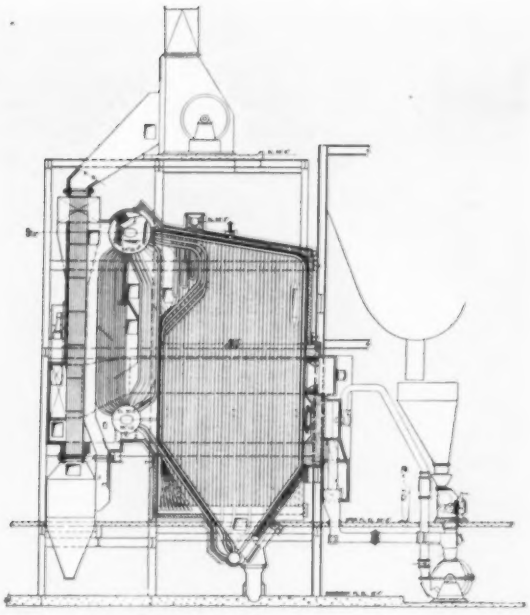


Riley TURBO FURNACE unit
Steam Capacity 289,000, 675 psig, 670 F.

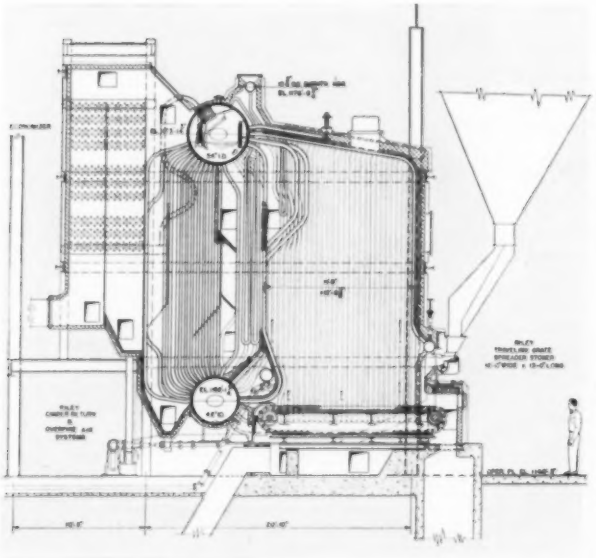
Prominent West Virginia Chemical Company
Replaces several low capacity, low efficiency units. Flyash reinjection eliminates flyash disposal problem, reduces carbon loss to minimum. Slag blowers not required.



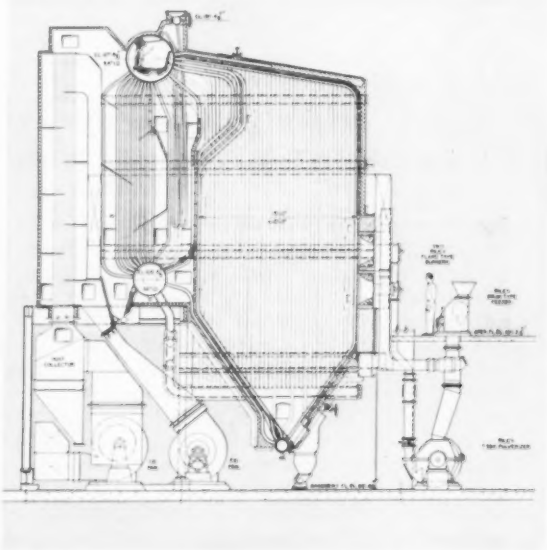
Western Electric Co., Hawthorne Power Plant
Three 200,000 lbs/hr Riley Boilers fired by Riley Pulverizers, Riley Gas, Oil, Coal Burners, Single Header Hopper, 1000 psig, 835 F.



Flintkote Company, Ridgefield Park, N. J.
One 60,000 lbs/hr Riley Boiler fired by Riley Pulverizer, Burners. Riley Air Heater, Single Header Hopper. 200 psig, 477 F.



Pennsylvania Railroad — Juniata Shops
Three 60,000 lbs/hr Riley Boilers fired by Riley Traveling Grate Spreader Stokers, 600 psig, 675 F. Riley Economizer. Cinder Reinjection.



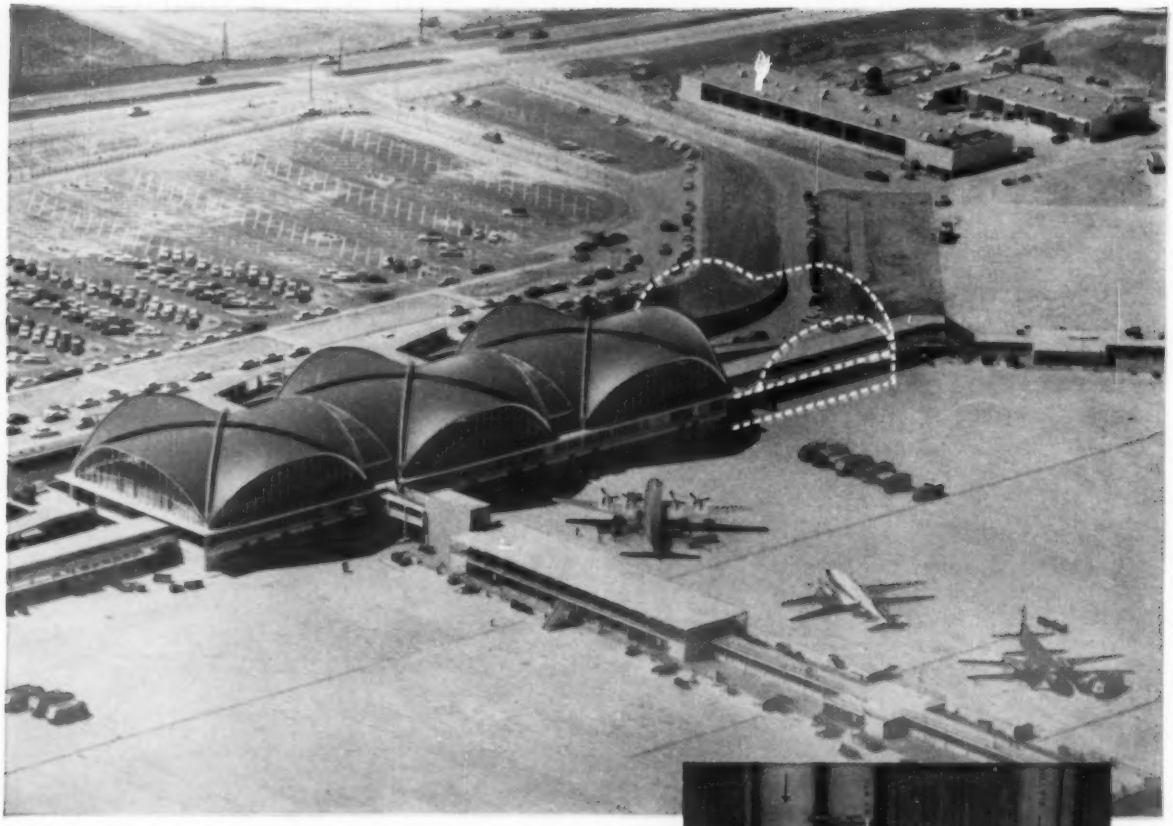
Thomas A. Edison Industries, West Orange, N. J.
Two 60,000 lbs/hr Riley Boilers fired by Riley Pulverizers, Burners. 450 psig, 515 F. Patented Riley Hopper Bottom. Riley Air-Heaters.

A survey of your plant by a qualified consulting engineer could show ways of making surprising savings in your power costs.

RILEY

STEAM GENERATING & FUEL BURNING EQUIPMENT

For more data circle 513 on Post Card



Nalco protects vital services of new
LAMBERT-ST. LOUIS AIRPORT

Functional efficiency is usually one of the hallmarks of fine architecture and it is apparent throughout the new St. Louis Municipal Airport Terminal Buildings.

Vital service facilities are housed in a low, clean-lined power plant, well separated from the present main terminal building in anticipation of planned expansion to accommodate increasing airline traffic. The Nalco System protects boiler and cooling water systems by effectively controlling scale, corrosion and microbiological growth . . . a non-architectural supplement to functional efficiency in *any* plant where water is used.

Whether you are planning a new plant, or modernizing an old one, call on Nalco for water treatment chemicals and services that consistently produce outstanding results.

Top photo: Unusual modern architecture of St. Louis Municipal Airport Terminal Building is expandable in any direction. New units (dotted lines), can be added readily when required. Services buildings, *upper right*, are built and equipped with future expansion in mind. *Photo by Lloyd Spainhower.*

Lower photo: Nalco Chemicals and Services protect both boiler and cooling water systems at new St. Louis Airport. In this photo a Nalco cooling water treatment, supplied in ball briquette form, is being applied through the convenient Nalco feeder.

NATIONAL ALUMINATE CORPORATION
West 66th Place • Chicago 38, Illinois
CANADA: Alchem Limited, Burlington, Ontario
NORTHWESTERN UNITED STATES, HAWAII and ALASKA:
The Flox Company, Inc., Minneapolis 3, Minnesota
ITALY: Nalco Italiana, S.p.A.
WEST GERMANY: Deutsche Nalco-Chemie GmbH
SPAIN: Nalco Espanola, S.A.

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HELPFUL BULLETINS

New and revised publications reviewed on these pages offer help on operating and maintenance problems. To order, use the handy Reader Service Cards provided on pages 105 and 106.

INSTRUMENTS AND CONTROLS

101 Supervisory Control — Bulletin GEA-6603, 16 pp, covers the what, why and wherefores of supervisory control equipment. Describes functions ranging from opening and closing of switches and valves, to adjustments of speed, voltage or load. Bulletin is designed to show versatility of supervisory control in helping to solve control problems economically. Includes charts, pictures, line connections and dimensions. General Electric Co.

102 Control Equipment Guide — Detailed information, technical data and prices on all types of automatic electrical control equipment is featured in 64-pp Catalog 18. Applications, construction details, engineering information and operating features are included, as well as general data and design specifications. Indexed in four sections, covering automatic transfer switches, contactors, special controls and timing devices, bulletin covers a wide range of equipment for practically all electrical timing and control requirements. Zenith Electric Co.

103 Flow Meters — Offered in 22-pp Bulletin F1607 are engineering data on differential pressure type flow meters, including basic information and theory on the selection, sizing and installation of the various types of primary devices. Approved installation practices for bases, liquids and steam are explained and illustrated. Equations for calculating throat diameters and flow rates and finding manometer ranges are given. The Bristol Co.

104 Temperature Regulators — Bulletin 1012, 6 pp, presents two series of steam regulating valves with pilots for both fast and slow heating exchangers. Describes types suited for instantaneous heaters (with pilots which handle heater pressures to 50 psi), and for slower acting heaters. Selection tables and line drawings of typical applications are provided. Spence Engineering Co., Inc.

105 Pneumatic Instruments — Catalog 510, 16 pp, describes indicating controllers for automatic control of pressure or temperature, transmitters for pressure or temperature indication, and receiver gauges in various designs, ranges and degree of accuracy and sensitivity. Tables of ranges, element characteristics, and bulb lengths are included. United States Gauge, Div., American Machine and Metals, Inc.

106 Thermal Element Data — Bulletin 110 is a selection guide for thermal elements for maximum resistance to corrosive atmospheres. Lists some 400 corrosive atmospheres into which temperature control elements are immersed. Gives recommended bulb material and other information relating to sustaining life of the temperature sensing bulbs in each atmosphere. The Partlow Corp.

107 Mill Regulator — Bulletin K-2503, 6 pp, describes a dual-circuit mill regulator which provides precise regulation of line speed, voltage and tension for continuous-process industries. Photos drawings and text cover features, operation. Reliance Electric and Engineering Co.

108 Engine Indicator — Bulletin EA-114 describes a combined electronic pressure indicator and engine analyzer designed to measure all internal combustion engine pressures, ignition and vibration in trouble-shooting, diagnosing, monitoring and adjusting the high-speed and high-compression engines. Kistler Instrument Corp.

109 Coal Scale Alarm — Product Data Sheet 5703 describes a coal-alarm system that provides automatic protection against coal supply failure in pulverizer or stoker-fired operations. Explains operation and includes two drawings illustrating magnetic impulse switch which transmits electrical impulses to control panel without direct mechanical connections. Diagram shows circuitry. Richardson Scale Co.

110 Industrial pH Equipment — Eight-pp Bulletin 5400 gives detailed descriptions and specifications for industrial pH instruments, electrodes and accessories manufactured by the company. Brochure is profusely illustrated with photos and detailed drawings. Process Instruments Div., Beckman Instruments, Inc.

MECHANICAL POWER TRANSMISSION

111 Adjustable Speed Drive — Twelve-pp Bulletin 2000 describes company's Select-A-Spede, an adjustable speed drive, available from 5 to 200 hp. The drive is a variable-voltage d-c drive using a-c as its power source. Its applications in machine tools, metal processing, textile, paper making, test stands etc. are discussed. Also stressed are ease of installation, optional features for special applications and economies effected. The Louis Allis Co.

112 Variable Speed Drives — Bulletin 195, 8 pp, covers company's line of variable speed drives, illustrating several Speed-Trol motor applications and providing selection information. Design advantages are explained and illustrated. Also described are automatic and mechanical remote controls available. Sterling Electric Motors, Inc.

113 Shaft Mounted Drives — Bulletin 7100, 32 pp, describes all-steel, helical gear, shaft mounted drives for applications in the range from ½ to 50 hp and from 420 to 5 rpm output speed. Covers unit design and construction and provides suggestions on using the drives. Also given is information on how to select proper size and ratio of unit, sheave and belt. Includes data on accessories, installation pictures. The Falk Corp.

114 Flexible Couplings — Bulletin 10100, 8 pp, features five tables which short-cut the usual engineering calculations involved in selection of flexible couplings. Advantages of company's line of flexible couplings are fully detailed in this bulletin. T. B. Wood's Sons Co.

115 Shaft Couplings — Bulletin 98 describes various applications of full-floating shaft couplings used for connecting shafts that are spaced far apart. Details of design and installation are pictured, described. Thomas Flexible Coupling Co.

116 Coupling Solutions — Helpful information on shaft coupling problems is presented in two bulletins. Of a general nature, Bulletin F-10 lists conditions where shafts and couplings should be considered. It outlines types and describes company's design assistance available. Engineering data, presented in 8-pp Bulletin F-11, is intended to simplify flexible shaft selection and installation. H. S. Watson Co.

ELECTRICAL

117 Outdoor Motors — Features contributing to outdoor dependability of this manufacturer's weather-protected motors (Type FOD) are described in Bulletin 51B8606B. These motors come in sizes NEMA frame 505 through 800 hp at 3600 rpm. Construction characteristics are explained and illustrated and motor ratings provided. Allis-Chalmers Mfg. Co.

118 Induction Motors — Sixteen-pp Bulletin 1950 presents detailed information on a full line of large induction motors in ratings from 150 to 1250 hp. Cutaway drawings and illustrations show design and construction features. The Louis Allis Co.

119 Outdoor Stations — Bulletin GEA-5573B, 20 pp, discusses integrated stations, rated 7.5 to 230 kv, from plans to installation. Describes station construction, typical arrangement of stations from simple step-down to complete sub-transmission station. Includes charts, pictures, line connections and standard dimensions. General Electric Co.

120 Substation Structures — Bulletin 57107, 12 pp, describes and illustrates company's simplified method of erecting standardized substation structures. Basic information on footing and anchor-bolt layouts, structure grounding methods, and minimum clearances for electrical connections is included. Details of how various structure members are joined to obtain maximum strength are also shown. Line Material Industries, McGraw-Edison Co.

121 Transformers — Some of the research facilities for company's wide line of transformers, along with their design and construction features, are described in 20-pp Bulletin 61 B 6186C. Covered are power transformers, unit substation, secondary network, industrial application, furnace, distribution, and instrument transformers. Allis-Chalmers Mfg. Co.

122 Interlocked Cable — Twelve-pp Bulletin RCP-730 describes four types of interlocked armored cables: 600-v, 5000-v, 15,000-v grounded neutral, 15,000-v ungrounded neutral. General information is given on installation, circuit flexibility, accessibility, moisture resistance, mechan-

ical toughness, ampacity and space requirements. Tables show AWG or MCM size, number of strands, insulation thickness, diameters, weights and current ampere ratings. Technical data on the 15,000-v ungrounded neutral cable includes correction factors for ambient air temperatures, aluminum conductors. Rome Cable Corp.

123 Wrought Iron Conduit — Included in 8-pp Form 680 on wrought iron pipe is a discussion of the metal's composition and a description of added corrosion protection provided by company's sherardizing method of galvanizing and acid resistant vinyl enamel processing. In addition to appropriate photos of actual installations and a list of suggested uses, book contains specifying information, dimensional and weight data. National Electric Products Corp.

124 Underfloor System — Sixteen-pp Catalog 857 describes and illustrates Power Raceway — an underfloor electrical distribution system for industrial and commercial buildings. Catalog includes dimensional drawings and describes duct, supports, junction boxes and numerous fittings. Walker Brothers.

125 Overhead Line Connectors — Comprehensive information on electrical connections for overhead lines in transmission and distribution is offered in 100-pp Catalog OH 57 on connection techniques, connectors and installation tooling. Basic principles of splicing, tapping, deadening, and other applications are explained, with photos, drawings and charts supplementing text. A selector chart is also included. Burndy Corp.

126 Air Blast Breakers — Bulletin GEA-6644, 12 pp, discusses application of air blast breakers in metropolitan power systems where trend toward higher distribution voltages exists. Describes special features and includes cutaway views of equipment, pictures, one-line drawings, charts, ratings and dimensions. General Electric Co.

127 Capacitor Rack Assemblies — Bulletin PC4, 16 pp, describes single-row, three-row, and cluster-type capacitor rack assemblies manufactured by the company. Features, ratings and dimensions are outlined and photos and dimensional diagrams showing important features are included. Line Material Industries, McGraw-Edison Co.

128 Semi-Conductor Rectifiers — Bulletin 12B8897 describes semi-conductor rectifiers — germanium, silicon and selenium — particularly applicable in the electro-chemical industries as well as general industry. The three types of semiconductor rectifiers are applied for director currents and voltage ratings as indicated on a chart. Allis-Chalmers Mfg. Co.

129 Electronic Equipment — Meter calibrators, voltage regulators, digital readout meters, d-c power supplies and other electronic equipment for either laboratory or production use is described in this 8-pp bulletin. Specifications are included. Davenport Mfg. Co.

PUMPS, PUMPING

130 Rotary Pumps — Twelve-pp Bulletin TLP-57 presents company's Twin-Lobe rotary positive displacement pumps, featuring simplicity, efficient operation and ability to handle a wide range of products. Provides analysis of performance characteristics, graphs on operating speeds and ranges, corrosion resistance charts, data on seals and specifications for determining pump size, speed. Manton-Gaulin.

131 Multi-Stage Pumps — Catalog B-100 describes company's line of vertically split case, multi-stage pumps. Design and construction features are described and performance curves and metallurgical details included. Economy Pump Div., C. H. Wheeler Mfg. Co.

132 Vertical Pumps — Bulletin 726.2, 12 pp, describes company's line of heavy duty vertical centrifugal sump and process pumps. Includes specifications, sectional views, performance ratings, and a chart of construction materials for interchangeability. Goulds Pumps, Inc.

133 Heavy Duty Pumps — Twelve-pp Bulletin 1157 presents company's Triplex pumps for use where high pressures (to 20,000 psi) and temperatures (in excess of 500 F) are required. Applications include operation of hydraulic test equipment, lubricating systems, others. Provides complete description of the pumps along with ratings. Pictures some installations. Kobe, Inc.

134 Metering Pump — Bulletin 1157 describes a metering pump with diaphragm liquid end. Specifies capacities, pressures and materials of construction of the leakproof pump for metering corrosive, obnoxious or toxic chemicals. Also discusses such features as mechanical actuation for correcting volume of hydraulic fluid between each stroke. Milton Roy Co.

135 Air Pumps — Bulletin 9755 offers 24 pp of detailed blueprints showing actual installations of rotary air pumps for vacuum and pressure operations, including lifting, blowing, suction, extraction, testing, materials transfer, drying, filling, chucking, feeding, packaging, other air applications. Leiman Bros., Inc.

SAFETY

136 For Fire Protection — Twelve-pp Catalog P-40 describes and illustrates portable fire extinguishers, built-in carbon dioxide fire extinguishing systems, smoke detecting systems and rate-of-rise fire detecting systems. Equipment covered is for industrial, institutional and commercial building fire hazard applications. Walter Kidde & Co., Inc.

137 Radiation Protection — This 8-pp booklet describes radiological health and safety consulting service offered by this company. Among the services described are safety consulting, radiation surveys and chemical and biological analyses. Combustion Engineering, Inc.

FANS, VENTILATION

138 Fan Testing, Rating — "Prototype fan testing and computations for testing fan equipment" is the subject of Bulletin 151-57. Tells how prototype fans are tested to obtain accurate performance characteristics for a complete series of fans of the same or larger sizes. Also covered are definitions of test rating, deviations from the fan laws. Air Moving & Conditioning Association, Inc.

139 Air Engineering — Illustrated with photos and diagrams, 8-pp Bulletin 135 covers the subject of air engineering for process and chemical industries. Includes a collection of brief descriptions with some application and capacity information on apparatus manufactured by company. Niagara Blower Co.

140 On Certified Ratings — Technical Bulletin 153-57 gives details of an industry-wide program designed to help specifiers of air moving equipment — centrifugal, axial and propeller fans, and power roof ventilators — to identify air moving equipment certified to perform according to published performance ratings based on official tests. Typical test set ups and performance curves for fans are included as well as requirements for qualifying products and laboratories and safeguards against misuse. Air Moving and Conditioning Association, Inc.

VALVES, PIPING

142 Valve Selection Guide — Incorporating cross-section illustrations, 56-pp Catalog 58-59 provides comprehensive characteristics and data to aid in selection and application of valves. These valves are rated for oil, water and air pressures ranging from 0 to 250 to 0 to 10,000 psi. in four-way, three-way, shut off and diverter flow patterns, manual and solenoid. Other sections contain graphs determining means of calculating pressure drop, discharge and velocity of liquids. Book also summarizes probable causes and remedies for more difficult maintenance problems. Available to qualified power engineers, please state your job title. Barksdale Valves.

143 Sliding Gate Valves — Six-pp Bulletin J-160 gives information on sliding gate pressure reducing valves designed for dead end shut-off on all fluid services. Describes the valves' features, design improvements and method of operation. Contains flow capacity charts, dimensions, control ranges and material specifications. Jordan Industrial Sales Div., OPW Corp.

Postage-free cards for ordering bulletins are on page 105. You may also use the cards to order literature mentioned in the ads.

144 Refrigeration Valves — Twenty pp Catalog R-6 gives size and application data for refrigeration and air conditioning brass valves, accessories and fittings. Incorporates recent technical data on relief valves, hermetically fused sight glasses and high capacity heat exchangers. Superior Valve & Fittings Co.

145 Joint Pipe — Advantages of company's joint pipe — a centrifugally cast iron pipe for water, sewage and other liquid service — are detailed in this 12-pp bulletin. Also covers the double-sealing single gasket type joint. Specifications are included, as well as information on assembly, fittings, and photos of typical installations. American Cast Iron Pipe Co.

DUST CONTROL

146 Industrial Dust Control — Bulletin 104, 36 pp, on company's dust filters, gives detailed information about dust control systems and how to engineer

USE DETROIT SPREADER STOKERS TO BURN SOLID FUELS WITHOUT EXPENSIVE PREPARATION

DETROIT ROTOGRATE • ROTOSTOKER • ROTOSTOKER (TYPE C-C)

HIGH ECONOMY AND AVAILABILITY • LOW MAINTENANCE

1

DETROIT ROTOGRATE

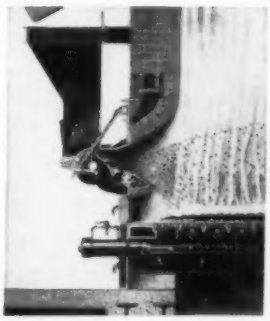
Original spreader stoker with forward moving grates that discharge the ash at the front. Our long experience has contributed to many exclusive refinements and features of design. Proven superiority with hundreds installed here and abroad. For capacities up to approximately 400,000 pounds of steam per hour.

Detroit Stokers burn any Bituminous Coal or Lignite without special preparation. Commercial sizes ranging from 3/8" x 0" to 1¼" x 0" are ordinarily used. High burning rates without clinkering difficulties. Also many refuse fuels including wet bark, hogged wood, bagasse, etc. are burned separately or in combination with coal; efficiently and without smoke.

Widely fluctuating loads are easily handled. Parasite power is negligible. High overall efficiencies at all capacities are assured. Maximum availability and very low maintenance.

Buy "Detroit"—They are "the most".

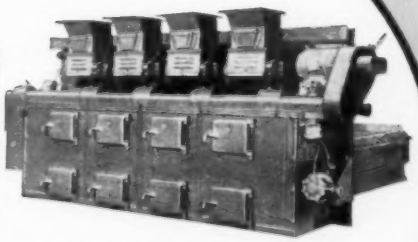
2



DETROIT ROTOSTOKER

For small and medium size units. Power Dumping, Hand Dumping or Stationary grates to fit the furnace provide desired capacity under full automatic control.

3



DETROIT ROTOSTOKER (TYPE C-C)

Continuous cleaning type particularly suited to highly fluctuating loads. Many sizes for capacities of 5,000 to 75,000 pounds of steam per hour. Reciprocating grates discharge ash at front. No basement is required.

DETROIT STOKER COMPANY

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The battery 'engineered for control' ... 25-year life ... low maintenance

C & D PlastiCal®

What will be happening when the 1980's roll around? The only thing you can be reasonably sure of is that the C & D *PlastiCal®* Control Batteries you install today . . . *will not require replacement until then.*

Twenty-five-year life? Yes! C & D "Control" Batteries are not only designed specifically for control, switchgear, and auxiliary power applications—they're engineered to last a quarter of a century. Users even boast that these advanced lead-calcium plate batteries only have to be watered about *once a year.*

For ample, dependable battery power *instantly* when you need it, it pays to specify C & D *PlastiCal.* It pays . . . in the long run, too.

For details, send for Bulletin CP-536

C&D BATTERIES, INC.
of Conshohocken, Pa. ... Attica, Ind.

SINCE 1906

SALES AND SERVICE OFFICES IN PRINCIPAL CITIES FROM COAST TO COAST

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them. Includes description of operating principles of the Roll-Clean Dynaclone dust filter, as well as information, capacities and dimensions for other Dynaclone and automatic continuous dust filters, intermittent filters, and unit and economy filters. Also provides dust filters and dust control system specifications. An engineering section gives step-by-step procedure for determining type and size of hooding, piping. The W. W. Sly Mfg. Co.

147 Dust Filter — Eight-pp Bulletin G-579 describes industrial dust control utilizing company's dust filter with non-variable air volume counter flow for maintaining filter media porosity. Includes cutaway views, dimensions and specifications for five basic units. The Day Co.

148 Oil Bath Aftercleaner — Bulletin 285A, 8 pp, describes advantages of company's oil bath aftercleaner — an automatic, self-cleaning dust collector that separates dust from the air as it passes through a viscous crimped-wire, fluid bed pad. Engineering data and dimensional diagrams are included with the text. American Air Filter Co., Inc.

HEATERS, HEATING

149 Unit Heaters — Advantages of heatings with Thermolier unit heaters are detailed in 21-pp Catalog uh-57. Features, types, selection, application and maintenance are covered and capacities, dimensions, wiring and piping diagrams, and sound ratings given. Grinnell Co., Inc.

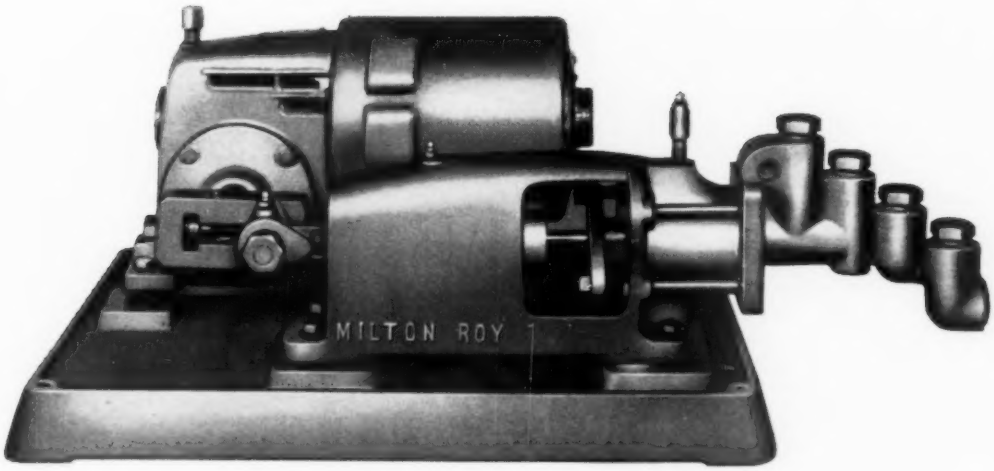
150 Industrial Heater — Bulletin 750A, 28 pp, covers construction, application and performance features of the Herman Nelson industrial heater, a heating and ventilating unit designed for make-up air or for plant heat load. Bulletin provides explanations of applications and arrangements of the unit, fan sections, coil sections, filter sections, other components. Performance graphs and charts show steam capacities, air flow resistance and other data. Dimensions are given, and a special section is devoted to adaptation of company's Roll-O-Vent to heater. American Air Filter Co., Inc.

151 Heating Cables — Bulletin 19-457, 12-pp, contains detailed information on heating cables, their application and installation. Product information and specification data on five types of cable are given: lead-jacketed, silicone rubber, asbestos-braided, and silicone rubber resistance wire. General Electric Co.

LUBRICATION

152 Centralized Lubrication — Application of centralized lubrication to industrial machines or vehicles is detailed in 12-pp Catalog 34-28. Analysis of machine bearings is among the subjects discussed, as are selection of lubrication interval, selection of system components, selection of appropriate lubricant, installation procedure. Alemite Div., Stewart-Warner Corp.

153 Hydraulics and Lubrication — This 20-pp hydraulics and lubrication manual for automated special machine tools is illustrated with photos, tables, line drawings and hydraulic circuits. Brief descriptions and overall illustrations of semi-automated trunnion and rotary-index type machines are provided along with similar material for automated center column-type machines and fully auto-



Look Twice

At the Milton Roy Motor-Driven Controlled Volume Pump

Patented Step-Valve liquid ends provide precise metering of chemicals . . . corrosive, viscous, or slurry solutions are handled with an accuracy of plus or minus one percent. Air binding can't occur because there are no pockets to collect gases.

This flexible unit is adaptable to manual or automatic control of capacity . . . has capacities from 3 milliliters to 2700 gallons per hour against pressures to 25,000 psi.

Take a second look at the Milton Roy approach to your metering and controlled volume pumping jobs, especially for boiler water and other water treatment applications. See how this quality equipment assures you the accuracy and dependability you *must* have. For complete information, write Milton Roy Company, 1300 East Mermaid Lane, Philadelphia 18, Pennsylvania. Engineering representatives throughout the world.

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Chemical Feed Systems • Anders Air and Gas Dryers

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Here's POWER to clean tubes from 1/2" to 2" QUICKLY

Expanding scraper and replaceable element.

Expanding brush and replaceable element.

Sectional wire brush.

Air valve for one-man operation.

Rotojet Junior Tube Cleaners are unusually powerful for their size and weight. They are fed easily through the tubes with the operating hose, and can be shifted quickly from tube to tube. Their convenient size, speed, and ease of operation offer a marked contrast with external cleaners costing many times more.

An air valve directly behind the Rotojet motor permits one-man operation. Very little headroom is required, and either vertical or horizontal tubes can be cleaned.

Simplicity of Rotojet design and precision construction assure long service, efficient use of power, and freedom from trouble. Economical brushes, cutters, and scrapers meet practically any requirement.

Send for Bulletin J-410.

ROTOJET®

Junior TUBE CLEANERS

ELLIOTT COMPANY—ROTO PLANT

Tube Cleaner Specialists Since 1910

147 Sussex Avenue, Newark, N. J.

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mated transfer-type special machine tools. Instructions for general hydraulic and lubrication system maintenance are included along with a lubrication chart. Snyder Tool & Engineering Co.

154 Plug Valve Lubricants — Reference Book 39 — Section 5A, 16 pp, describes company's plug valve lubricants and lubrication accessories. Standard lubricant table gives detailed description and extreme temperature range of each lubricant. A list of suggested lubricants is included. Homestead Valve Mfg. Co.

OTHER EQUIPMENT

155 Low-Level Condensers — Bulletin 5AB, 8 pp, describes company's line of low-level Eductor and Multi-Jet condensers for condensing steam, under vacuum, at ground level. Application, construction and operation information on both types of condensers is furnished, and complete sizing data, as well as capacities, weights, and dimensions included. Schutte and Koerting Co.

156 Vertical Boiler — Detailed description of company's vertical fire tube boilers is furnished in this recently published bulletin. A data table, instructions for installing and operating and cutaway views showing component features are included. Hamburg Boiler Works Inc.

157 Tungsten Arc Welding — Catalog 2300, 24 pp, features an inert-gas-shielded tungsten arc welding process for rapid joining of light gages of most engineering metals and alloys. Advantages of Heliwelding are detailed and manual, semi-automatic, automatic and accessory equipment covered. Description and specifications for tungsten electrodes also furnished. Air Reduction Sales Co., Div. of Air Reduction Co., Inc.

158 Steel Reservoirs — Advantages of company's steel reservoirs and standpipes for water storage are detailed in Bulletin 555. Size and capacity data are tabulated, and typical reservoirs are pictured. Koven Fabricators, Inc.

You'll save time in ordering bulletins by using the Reader Service Cards on page 105. Of course we honor letterhead requests—but it takes us somewhat longer to handle them.

159 Vibration Control — Bulletin K3B gives latest data on stopping vibration, shock and noise transmission by using steel spring machinery mountings. Describes company's Vibro-Isolators and includes typical case histories of actual installations, as well as data tables giving capacities and characteristics, and drawings of typical installation arrangements. The Korfund Co. Inc.

160 Pressure Vessel Code — Information on pressure vessels or heat exchangers meeting ASME Boiler and Pressure Vessel Code, Section VIII (Unfired Vessels) is offered in this index to the ASME Code. Contains four indexes telling: where in Code to find reference to specific pressure vessel construction details; when radiographing is required by Code; when stress-relieving is required; where to locate

Hall Industrial Water Report

VOLUME 6 MARCH 1958 NUMBER 2

Steam-Electric Power Plants Have to Keep Rolling

If they don't, our whole complex machinery of civilization suddenly dies. Mills go down, office buildings go dark, air conditioning stops—even television is blinded.

Undisciplined water can cause unscheduled outages. That is why upwards of 300 utilities and more than 2500 industrial steam generating plants retain Hall Laboratories to help them avoid water problems and to solve them when they do occur. This is a most important part of Hall's activities on all kinds of industrial water—cooling water, service water, process water, waste water.

Disappearing Phosphate

One summer the operators in a Midwestern utility plant were puzzled by the disappearance of boiler water phosphate residuals over a number of consecutive week ends. Then to their dismay, boiler tubes began to fail as a result of scale formation.

It was obvious to Hall Engineer J. F. Nelson that the boiler feedwater was being contaminated with hard water over week ends, but finding the point of contamination proved difficult. Innumerable samples of feedwater drawn hourly by the operators showed only the usual 0.5 ppm or less of hardness. However, one night when the air conditioning load dropped abnormally because of cooler weather, hardness showed up. It was traced to a small boiler feed pump used only for light loads. Hard water used for sealing was leaking into the pump suction when load was sufficient to reduce the pressure below that of the sealing water.

Diagnosis had been difficult because contamination occurred only with the small pump used when loads were light and only when this pump was operated at full capacity. These conditions were experienced mainly over week ends.

As with most problems, correction was easy once a satisfactory diagnosis had been made. Substitution of condensate for hard water as gland sealing water eliminated the contamination regardless of load.

An Opportune Visit

On a routine visit to a western utility plant Hall Engineer C. L. Fitzgerald found management trying to decide what to do about preparation of makeup water for a new steam-electric unit. The inclination was to use existing evaporators because of a $100,000 price tag on demineralizing equipment. How to pretreat evaporator feedwater was the pressing problem.

The existing pretreating equipment consisted of an old lime-soda plant operated batchwise in the cold. Consideration was being given to costly, extensive repair work on the old plant and to installation of individual chemical feed tanks and proportioning pumps for the evaporators. Fitzgerald agreed that the changes contemplated would facilitate water treatment and improve evaporator feedwater conditions and vapor quality. However, he was quick to propose an alternative which would involve lower capital investment and operating cost.

Fitzgerald's recommendation was to scrap the existing equipment and to replace it with sodium zeolite softeners costing approximately $2000. Two existing tanks could be used for storage of softened water and one chemical tank and proportioning pump would suffice to feed chemicals into the water line to the evaporator preheater. This arrangement would not only produce excellent quality water for the evaporators but it would do so with a minimum of attention and at low cost.

The scheme proposed was not hard to sell to management. Capital expenditure dropped by stages from the first considered $100,000 to a final figure of close to $2000. The daily saving in chemical cost was sufficient to amortize the expenditure in little more than one year.

Why So Much Copper

When a routine analysis disclosed the presence of an unusually high concentration of copper in the recirculating cooling water at a midwestern city light plant, the operators were justifiably alarmed. That the copper was accelerating corrosion of steel was indicated by a steel test strip removed from the cooling water system. Along with severe pitting, the strip showed copper plating.

No copper compound was being used as an algaecide. Furthermore, routine checks showed the pH value of the circulating water to be 8.0, high enough to control corrosion of copper alloy condenser tubes.

Hall Engineer W. E. Pfeiffer reasoned that the copper source had to be the condenser tubes. Perhaps pH control was not really as good as indicated. Upon investigation, he found that the operators, to facilitate acid feeding, had changed the point of application and were feeding intermittently at hourly intervals. Further determinations revealed that while the pH value of the circulating water at the condenser outlet was 8.0 when acid feed was started, during the short period of acid introduction it dropped to 3.0.

With the problem in focus, changes were made to feed acid properly and thus return to normal the copper content of the water and the operator's peace of mind.

Industrial Water Problems Require Special Handling

There are no "stock answers" to industrial water problems. For information on how the Hall System can help you solve your particular water problems, write, wire or call address below.

Water is your industry's most important raw material. Use it wisely.

HALL LABORATORIES
DIVISION OF HAGAN CHEMICALS & CONTROLS, INC.
HAGAN BUILDING, PITTSBURGH 30, PENNSYLVANIA
DIVISIONS: CALGON COMPANY, HALL LABORATORIES
IN CANADA: HAGAN CORPORATION (CANADA) LIMITED, TORONTO

Hall Laboratories—Consultants on Procurement, Treatment, Use and Disposal of Industrial Water

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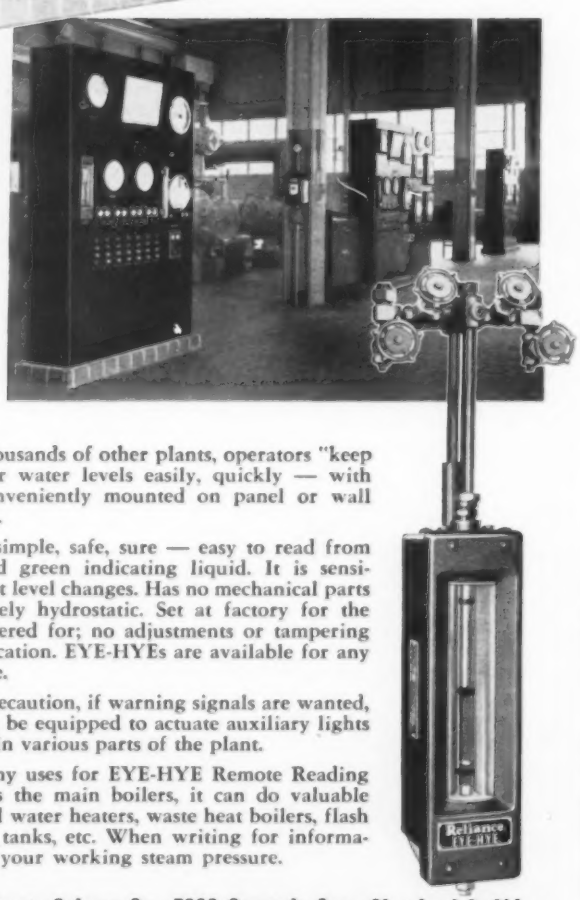
EYE-HYE

gives quick, accurate boiler water level reading for each drum at new automotive plant

Close-up of one of three panels shown below, in power plant of Chrysler Stamping Plant, Twinsburg, Ohio.



Here, as in thousands of other plants, operators "keep tab" on boiler water levels easily, quickly — with EYE-HYE conveniently mounted on panel or wall where wanted.

EYE-HYE is simple, safe, sure — easy to read from its illuminated green indicating liquid. It is sensitive to slightest level changes. Has no mechanical parts — is completely hydrostatic. Set at factory for the boiler it's ordered for; no adjustments or tampering possible on location. EYE-HYEs are available for any boiler pressure.

As an extra precaution, if warning signals are wanted, EYE-HYE can be equipped to actuate auxiliary lights and/or horns in various parts of the plant.

There are many uses for EYE-HYE Remote Reading Gages. Besides the main boilers, it can do valuable service on feed water heaters, waste heat boilers, flash tanks, storage tanks, etc. When writing for information, mention your working steam pressure.

The Reliance Gauge Column Co., 5902 Carnegie Ave., Cleveland 3, Ohio

For more data circle 520 on Post Card

ASME and TEMA reference to heat exchanger design features. Downington Iron Works, Inc.

161 Refractory Mortars — Six-pp Bulletin 600 covers the complete line of refractory mortars manufactured by the company. Included are installation photos, product features and technical data containing recommended maximum use temperatures, fusion, types of set, form, pounds required per 1000 brick for trowelling, dipping and brushcoating. J. H. France Refractories Co.

162 Acid Cleaning Effects — This folder presents a report on the effects of repeated acid cleanings on boilers, heat exchangers and process equipment. Four case histories are given briefly covering from five to 44 cleanings of the equipment in question. Advantages of company's cleaning service are told. Dowell Inc.

163 Nondestructive Testing — This bulletin describes a number of nondestructive testing services available. It covers ultrasonics, flaw detection, thickness measurement, x-ray, consulting and application engineering, and fluorescent penetrant inspection. Roberts and Randolph Ultrasonics Co.

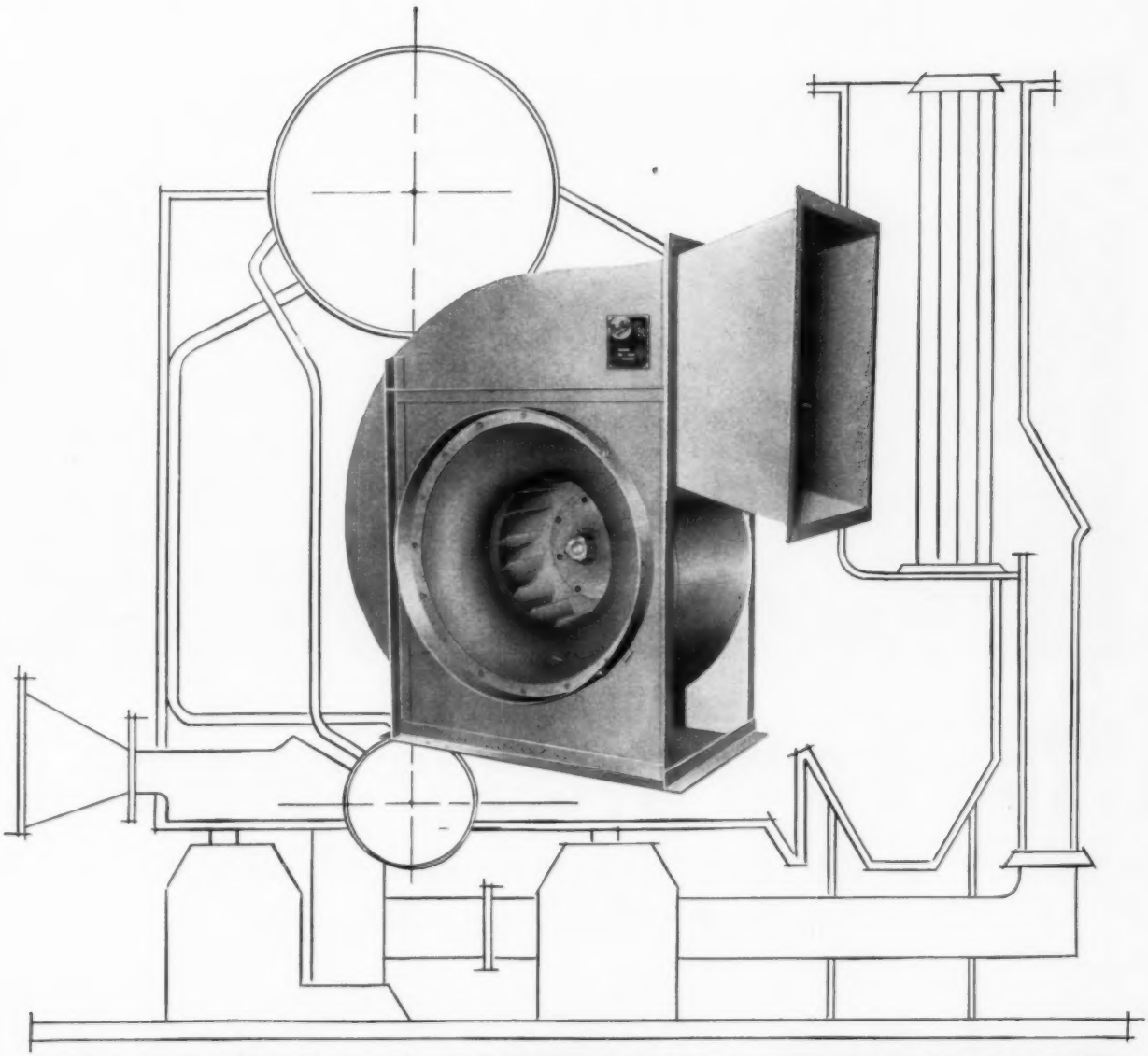
164 Wall Deslagger — Bulletin 1034 describes design features of furnace wall deslaggers designed to minimize average slag thickness for consistently high heat-transfer capacity, and for uniform superheat and reheat temperature control. Cross-sectional drawings and schematic sketches included. Copes-Vulcan Div., Blaw-Knox Co.

165 High Capacity Chlorinator — Twenty-pp Catalog 70-15 describes features, construction and application of a vacuum-type, solution-feed, high capacity gas chlorinator suitable for manual, semi-automatic or fully automatic operation in capacities from 60 to 8,000 lb of chlorine per 24 hr. Dimensions and specifications are included, as well as typical installation diagram. Fischer & Porter Co.

166 For Steel Industries — Forty-pp Brochure Q-23A presents products and experience of this manufacturer as applied to steel and related industries. Some 100 installation photos and drawings are used. Sections are devoted to drives for steel mill auxiliaries, materials handling equipment, sintering plants, tube mills, and hot and cold rolling mills. This includes applications covering complete electrical systems from main motor-generators to auxiliary motors and control equipment. Elliott Co.

167 Plastic Laminate — Bulletin AD-152 describes corrosion resistant Kel-F plastic laminate for application to any surface having almost any contour. Outlines properties of the plastic lining material and explains advantages offered by use of the economically priced laminate. The Garlock Packing Co.

168 For Brush Control — This 24-pp booklet explains how this company's various herbicidal formulations and mixtures make possible year-round programs of foliage basal and stump spraying for maximum weed and brush control at substantial long-term savings of time and money. Tells effectiveness of such spray programs in reducing weed and brush population so that control becomes easier and more economical each year. A chart lists more than 50 common woody plants controllable. Monsanto Chemical Co.



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Write for Bulletin FD 205 and see the dependable, stable performance built into this husky radial wheel fan for constant volume or inlet-dampered operation. It's one of a *series* of specialized "Buffalo" Draft Fans — including airfoil and backward curve designs with a wide choice of wheels — to give you the best service your operation requires.

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BUFFALO, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo"

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HOW THESE INSTALLATIONS

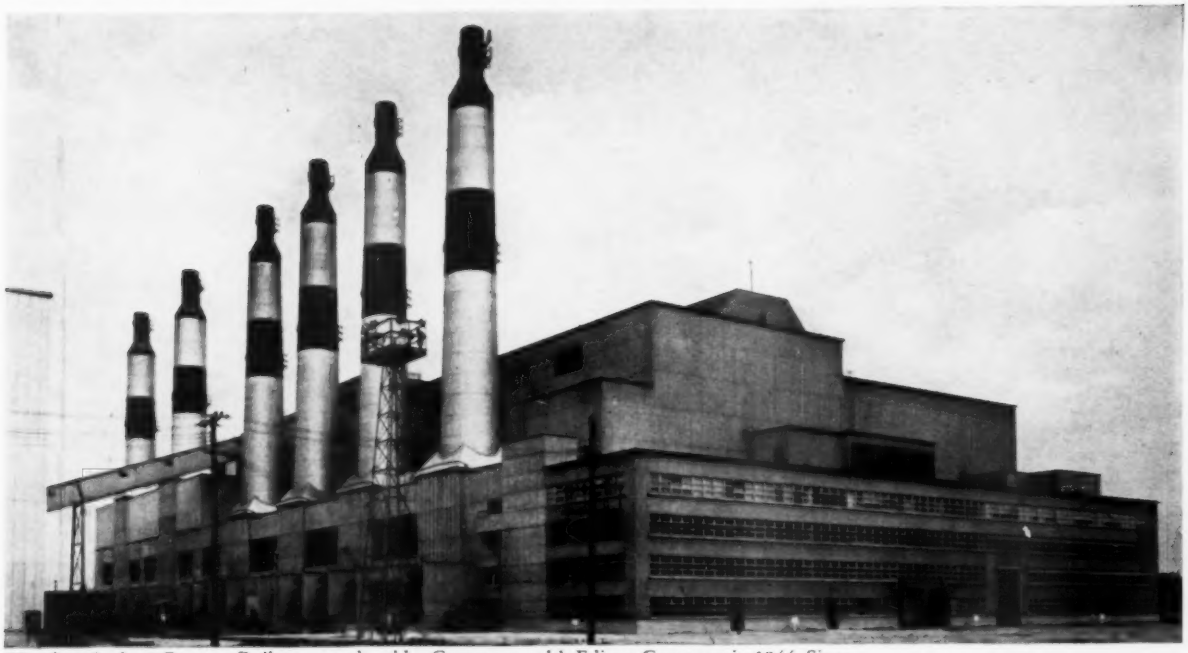
Jersey Central Power & Light Company's E. H. Werner Station. Here the success of the B&W Cyclone Furnace Boiler, the first installed in the East, has led to the purchase of two more boilers.

The B & W Cyclone Furnace...

A Modern, Economical Way to Burn Fuel for Power

Niles Station of Ohio Edison Company where two B&W Cyclone Furnace Boilers have been in operation since 1954.

UTILIZE LOW-GRADE FUELS



The first Cyclone Furnace Boiler was ordered by Commonwealth Edison Company in 1944. Since then this utility has purchased 15 more units, six of them for the Ridgeland Station shown here.

The B&W Cyclone Furnace simplifies the entire process of coal preparation, combustion, ash handling and ash segregation. Its cost-saving quality contributes to lower fuel costs and reduced maintenance as well as increased operational simplicity, flexibility and safety.

Although the B&W Cyclone Furnace operates simply and dependably on either oil or gas, it is particularly effective in utilizing inexpensive, low-grade coals. Its rapid combustion burns the coal more completely and operates with low excess air. Most of the ash is melted to slag right in the Cyclone Furnace, where it is easy to handle and dispose of. The slag cleaning and fly-ash problems so prevalent with other types of firing are consequently alleviated.

Many other modern advances in combustion and high-pressure, high-temperature steam generation are available through B&W. Write for further information today. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

PURCHASERS OF THE B&W CYCLONE FURNACE

	Number of Cyclone Furnace Boilers
FOR CENTRAL POWER STATIONS	
Atlantic City Electric Co.	1
Baltimore Gas & Electric Co.	1
Chilena de Electricidad	2
Columbus & Southern Ohio Electric Co.	2
Commonwealth Edison Co.	16
Consumers Public Power District (Nebraska)	1
Detroit Edison Co.	1
Indiana & Michigan Electric Co.	1
Jersey Central Power & Light Co.	3
Memphis Light, Gas & Water Division	3
Middle South Utilities, Inc.	1
Missouri Public Service Co.	1
Monongahela Power Co.	1
Northern Indiana Public Service Co.	3
Ohio Edison Co.	2
Ohio Power Co.	6
Public Service Co., of New Hampshire	1
Tampa Electric Co.	3
United Illuminating Co.	2
Wisconsin Power & Light Co.	4
FOR INDUSTRIAL INSTALLATIONS	
American Cyanamid Co.	1
American Enka Corp.	1
Columbia Southern Chemical Co.	1
Consolidated Water Power & Paper Co.	1
Dow Chemical Co.	5
Eastman Kodak Co.	1
Greenwood Mills	1
International Paper Co.	4
National Container Corp., of Wisconsin	1
Rhinelander Paper Co.	1
St. Croix Paper Co.	1
Thilmany Pulp & Paper Co.	1
West Virginia Pulp & Paper Co.	1
Total	**75**

G-882

BABCOCK & WILCOX

BOILER DIVISION

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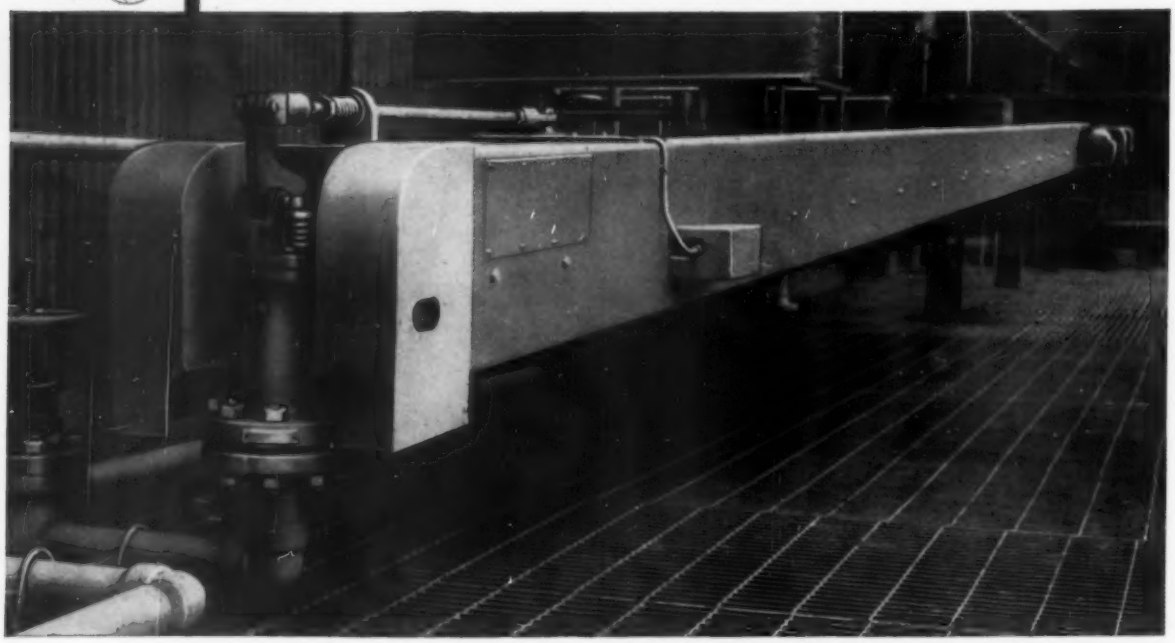
COPES VULCAN | BLAW-KNOX

How Copes-Vulcan control systems boost power plant efficiency



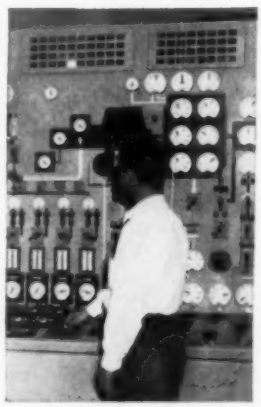
38-foot travel with this Vulcan T-30 on a 1400-psig utility boiler. Write for Reprint 1040, the story of this interesting installation.

Vulcan soot blowers clean widest furnaces ...simplify maintenance

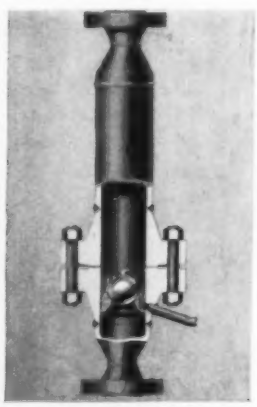
Vulcan long retractable soot blowers are products of years of experience in the utility field. A dual-motor drive permits one motor to extend and retract the lance, another to rotate it. This provides an infinite number of multi-helix jet patterns for *complete* coverage, *uniform* cleaning.

Built to withstand outdoor installations in all climates, these soot blowers feature simplicity of working parts to assure dependable operation with a minimum of outages for servicing.

One source ... one responsibility ... a complete service. Besides boiler cleaning equipment, Copes-Vulcan builds complete control systems for combustion, feed water, superheat and reheat temperatures, feed water bypass, pressure reducing and desuperheating. Whether furnished separately or integrated into a single package, each installation is custom-designed for the specified conditions. Write for Bulletin 1022-B.



Combustion control for every need. Copes-Vulcan combustion control adapts to all generating capacities, load ranges, pressures and fuels. Write for Bulletin 1032, the story of a utility installation featuring compact panel with miniature instruments.

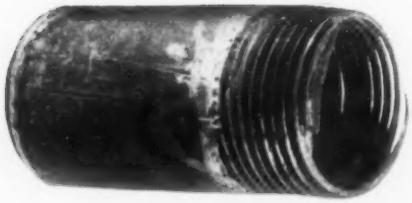


Desuperheater improves temperature control. New Copes-Vulcan Variable-Orifice Desuperheater holds reduced steam temperature constant only twenty feet downstream from desuperheater outlet, even over a 50-to-1 load range. Write for Bulletin 1037.

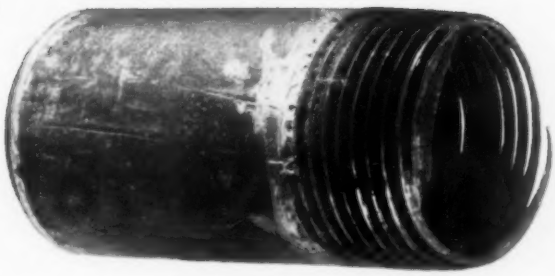
Copes-Vulcan Division
BLAW-KNOX COMPANY
Erie 4, Pennsylvania

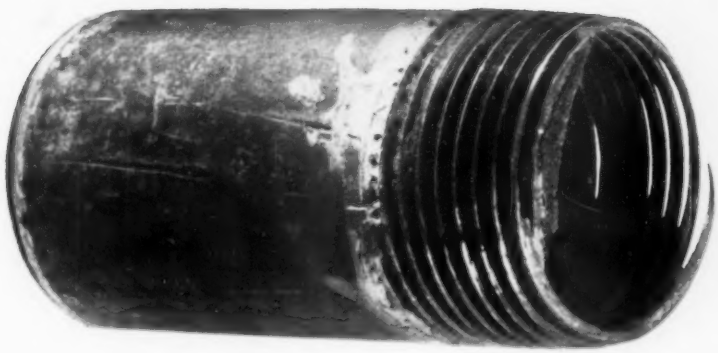
BK-4410

For more data circle 523 on Post Card



● *Unretouched photos showing carbonic acid destruction typical of untreated pipelines.*





EASY TO SEE THROUGH – AFTER IT HAPPENS

It's too late for water treatment after the damage is done. Replacement of these threadbare nipples in the return line was only a matter of time. The grooving-type corrosive action of carbonic acid took care of that.

Destruction like this can be stopped with Dearborn Alkameen,* an amine in liquid form which dissolves in the condensate to neutralize the corrosive action of carbonic acid.

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Power Engineering

ATOMICS

308 EAST JAMES STREET
BARRINGTON, ILLINOIS

A POWER ENGINEERING FEATURE FOR UTILITY & MAJOR INDUSTRIAL EXECUTIVES

A. W. Kramer, Editor

A Periodic Report on Atomic Energy Development Throughout the World
Published by Technical Publishing Co.

March 1, 1958

50,000 Kw from EBWR. When the Experimental Boiling Water Reactor was dedicated on February 9th of last year, it was made very clear that the reactor would operate at a heat level of 20,000 kw. That is the power output it was designed for.

Now hear this! On December 23rd, 1957, the operating level of EBWR was boosted from its original level of 20,000 kw to 50,000 kw, without any change in the number of fuel elements or their arrangement in the reactor core.

This astonishing performance can be interpreted in two ways. It can be regarded as a striking demonstration of the enormous power reserve inherent in a nuclear reactor or we may look upon it as an illustration of the fact that reactor design is not the precise art it may appear to be. It seems that both at EBWR and Vallecitos, the General Electric nuclear plant in California, the critical mass was estimated low. As Kenneth Davis explained it recently, in neither case did they have a critical experiment beforehand and the calculations were done very roughly since they had considerable flexibility in loading the reactors. As Davis put it, they had the choice of spending a million dollars building a critical experiment and finding out beforehand what it would be, or build the reactors fairly flexible and determine the critical mass in the reactor itself. In the case of EBWR it was decided to perform these critical experiments in the reactor itself. EBWR, of course, is an experimental plant. Its purpose is to test the feasibility of the direct boiling water cycle for nuclear power production. While it does supply electric power to the Argonne National Laboratory, it was built primarily to test an idea. Since this plant was placed in operation in December 1956, it has operated the equivalent of full power for 100 days in the first ten months of its life. According to Project Manager Joseph Harrer, over 15,000 kw-days of operation have been logged without incident. There have been no emergency shutdowns. Protective system tests have been run and at all times the equipment has met safety requirements.

This excellent performance record evidently indicated to those in charge, that EBWR could do much more. So, on December 23, the power level was raised to 50,000 kw -- two and one half times its original capacity! This was done merely by removing the control rods somewhat further. With the control rods further withdrawn than at the design level, the water in the core boiled at a higher rate resulting in faster re-circulation through the core and more rapid removal of heat. Since the electric generating unit is rated at only 5000 kw, the excess heat had to be dumped. If a larger generator were installed the system could easily produce 10,000 kw.

There is every indication that the maximum stable power is several times higher than the 20,000 kw for the present core. According to Harrer,

experience in the operation of the plant made it safer to raise the heat output to 50,000 kw than it was to bring the power up to 20,000 kw originally. Several other uncertainties were cleared up and with the information now available, Dr. Joseph Thie, Chief Physicist for the EBWR says that he now will be able to design a core which could operate for about four years at the new high power rate. The present core in the EBWR was designed for variable fuel loading; there was no attempt to achieve the utility type of continuous long-time operated core as is necessary in a commercial power plant. That is why the plant is called experimental.

Means Lower Power Costs. Of course, the commercial significance of this tremendous increase in output from the EBWR is that it reduces the potential power cost with this type of reactor, which, by the way, is perhaps the simplest type of power reactor. If the output were raised to three times the initial design rating, which is considered to be feasible, operating costs would be reduced from an estimated 52 mills per kwh to 32 mills (at 60,000 kw power output).

Obviously, 32 mill power is still far too high to be commercially competitive but Mr. Harrer feels that if four identical reactors of this type were built in one multiple reactor station -- with no extrapolation of design beyond what has already been learned -- operating cost would come down to about 12 mills. Even this would not be competitive but there is reason to believe that this figure can be lowered to around 10 mills per kwh during the next decade, thus bringing boiling reactors into competition with conventional plants. As a matter of record, some time ago, Willis Gale of the Commonwealth Edison Co indicated that the new Dresden Station using this type of reactor would produce electric power at something around 7 mills per kwh. Dresden will have a capacity of 180,000 kw.

* * *

Exotic Flower on a Poisonous Plant. Rumors about the success of thermonuclear research in Great Britain have been rife in recent months but little actual information concerning the nature of the advances has come to light. On January 4, however, The Economist published in England presented a short article announcing the fact that the British government would make a statement on controlled fusion in the near future, and that twelve months from now it should be possible to classify the outstanding scientific events in each of the three previous years:

1956 -- The opening of Calder Hall
1957 -- Launching of Sputnik
1958 -- The control of fusion

Each of these accomplishments, The Economist pointed out, is an exotic flower grown on a poisonous military plant -- two nurtured to maturity in England and one in the Soviet Union.

To decide which of the three will have the greatest impact on society and on the world's economies will need more than 12 months, but controlled thermonuclear fusion, with its promise of immense power and unlimited fuel from the sea, has the fairy-tale appeal of a cornucopia that lesser mortals miss in the chilly prospect of a journey to the stars.

It is far more than a fairy tale, however. While the difficulties in the way of thermonuclear power are enormous there seems good reason to believe that it can be attained. There is no reason to believe that it will be simpler or cheaper to harness than atomic fission, rather the contrary, but the stakes are higher. If the British government's statement shows that the experiments in Britain have been successful the bid for hydrogen power will be on. How long it will take to bridge the gap between a successful laboratory experiment and a working commercial power station is another story. What can sensibly be said at this stage is something about the way scientists might go about it and about fitting the fusion power system into an existing electrical network.

The technical difficulty about bringing the fusion process into useful service is to overcome revulsion of the nucleus of one atom for the nucleus

of another -- in technical parlance, the problem is that of overcoming the coulomb repulsion between two similar electrical charges. Since the nuclei of the atoms all carry positive electrical charges, they naturally repel each other with a force that varies directly as the magnitude of the charges and inversely as the square of the distance between them. The key to the whole fusion process, whether in a hydrogen bomb or in hydrogen power, rests on bringing the atoms, or rather their nuclei, sufficiently close for them to fuse together into one slightly larger atom. Extraordinary effort is needed to overcome the strength of the electrical repulsion, and the only workable approach that the scientists have found is to imitate the sun, where fusion is going on all the time, and create temperatures of 100 million degrees. A billion degrees would be much better. In the hydrogen bomb fusion is started by the intense heat of a fission explosion of an A-bomb which acts as a percussion cap. Fusion will start at temperatures from a million degrees upwards, but will not happen at a fast enough rate to present a useful source of power until the temperature is brought much nearer the 100 million degree mark.

Atoms under Pressure. All the mechanical, engineering, and metallurgical problems connected with harnessing H-power stem from this point; scientists are forcing atoms to do something that is basically unnatural to them and fantastic temperatures are required to bring about the reaction. The creation of high temperatures has presented the greatest difficulty. It is easy enough to provide sufficient voltage for the purpose; the difficulty is to stop the heat from being lost thus preventing the build-up of the temperature inside the container to a level that will sustain fusion.

Between 1948, when research into fusion first began, and the summer of 1957, scientists at Harwell managed to reach temperatures of 200,000 C; scientists in Russia reached temperatures of nearly one million degrees. The system used both by the Russians and the English (and also in the U. S.) utilizes the pinch effect -- the constriction of an electric arc or molten conductor by virtue of the magnetic field surrounding a current carrying conductor. The pinch effect brings about two desirable actions; first it concentrates the highly ionized gas -- the plasma -- into a dense, high pressure, high temperature region, and secondly, it draws the high temperature plasma away from the walls of the containing vessel. If the container is in the form of a tube, joined at both ends like a ring shaped doughnut, the current exerts its maximum effect on the plasma. But the pinch effect is not a neat and tidy phenomenon. One of the vital tricks in controlling fusion lies in knowing just how to apply the magnetic field to the gas column in a way that irons out its instabilities. The second, even more vital knack is to know how to hold the high temperatures long enough to heat the gas to a point where fusion occurs.

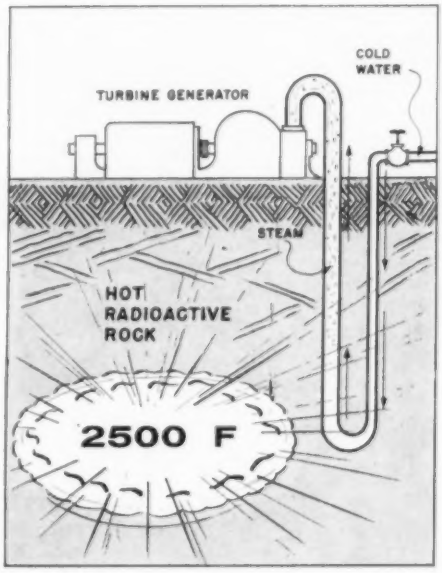
Several small doughnuts have been built at Los Alamos in the United States; one is working in France; but the biggest one has been constructed at Harwell in England. This apparatus was first started up on August 12, 1957. On August 30, this unit was first operated under conditions to produce nuclear reactions. Neutrons emitted in these reactions were observed when deuterium gas was heated electrically to temperatures in the region from 2 to 5 million degrees centigrade. The hot gas was isolated from the walls for periods of 2 to 5 thousandths of a second. The heating process was repeated every ten seconds. The high temperatures achieved together with the relatively long duration for which the hot gas has been isolated from the tube walls, are the most important experimental results obtained so far. While much longer times are needed for a useful output, these experiments seem to have demonstrated that Harwell has mastered the trick of stabilizing the gas column.

A power station based on this type of controlled fusion might consist of a battery of such doughnuts though some scientists think that a single one would suffice, since a large unit is potentially capable of releasing a million megawatts of heat in a single pulse. H-power is essentially a pulsed system. Whereas the fuel charge in a conventional atomic power station lasts from three to five years, the gas within the doughnut is burnt up in a second or less, after which the reactor has to be recharged with new gas and the voltage reapplied to bring it up to fusion temperatures. In theory it should be possible to get a

power gain 100 times as great as required to start the reaction but the engineers who are seriously studying the possibility of fusion systems do not think that they will be able to get anything like this gain in practice. Indeed, there is no reason to believe that a fusion power station would be able to generate electricity any more efficiently than an ordinary nuclear plant. Fusion does, however, offer unlimited power from an ever available source (sea water) for as long as the human race desires to look forward.

* * *

West Coast Jewelers Convention. Deep under a Nevada desert mountain there is a blister of boiling radioactive rock. It was put there by man's first underground explosion on September 19, when the AEC exploded a small atomic bomb at the end of a deep tunnel.



Nobody knows exactly what conditions are like 900 ft below the surface because drilling operations since the explosion have been unable to tap the hot pot of stone. The temperature of this region is more than 2500 F.

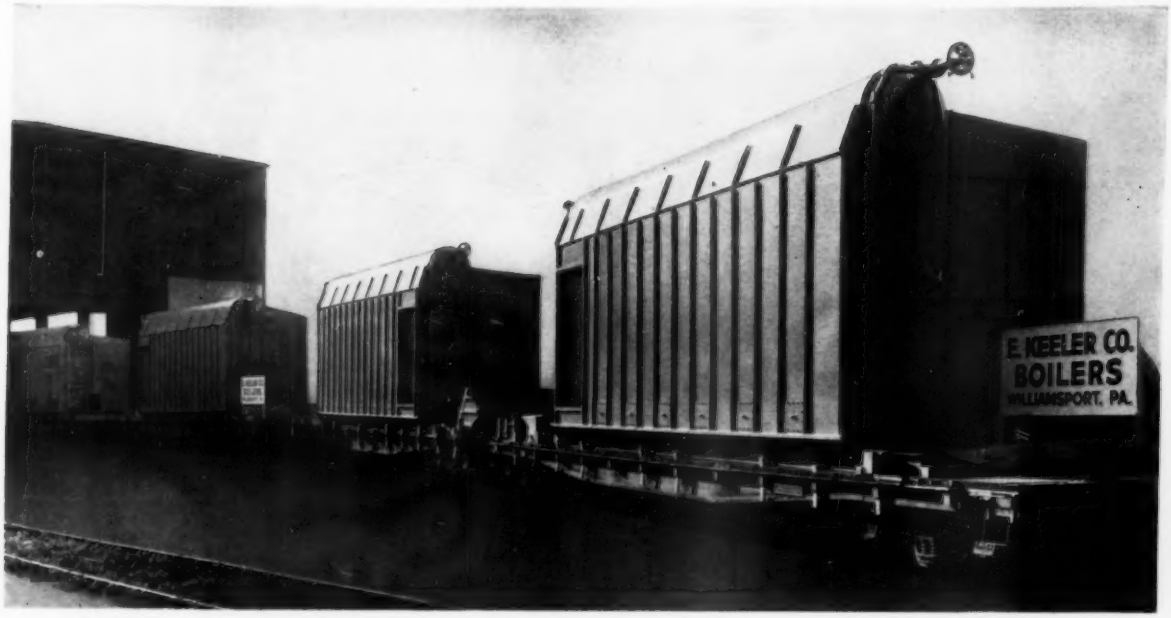
Dr. Willard Libby of the AEC said recently that he looks forward eagerly to the results because it opens up many fascinating fields for the peaceful uses of atomic blasts. He expected the first tap any day.

One such possibility has led some scientists to call the underground blast "The West Coast Jewelers Convention". The reason is this: the enormous heat and pressure of the blast might fuse the rock into strange substances never before seen on earth. There might even be diamonds there.

An interesting possibility arising from the presence of the hot rock below the surface is illustrated in the drawing on this page. The presence of the hot rock may provide another, perhaps cheaper way of deriving electric power from the atom. If the heat of the explosion is confined to a relatively small region, then it might be possible to pipe water down there, heat it and send the steam so produced to a turbine generator unit as shown. Actually, the heat might remain in one location for months because rocks are very poor conductors of heat. Measurements show that heat travels through rock at the rate of only about a foot per month. A system such as this would not necessarily produce radioactive steam because there would be little or no neutron radiation. Once the nuclear reaction is over there are no more neutrons to produce further radioactivity. This is not so in a nuclear reactor. In a reactor the continuous production of neutrons induces radioactivity in the substance removing the heat, be it a gas, water, or molten metal. But in the underground heat well, the coolant could pass through the radioactive zone without becoming radioactive itself.

In discussing this event, Dr. Libby explained that they did not know how much of the energy went into heating up the local rocks and how much went up into shaking the 7000-ft mountain. He reported, however, that the entire mountain was lifted six inches. Even this might be beneficial, said Dr. Libby. An underground explosion in a ''dried out'' oil field might make trapped oil flow into the wells and replenish them.

Thus, even our stockpile of atomic bombs might be put to peaceful uses.



Four 50,000-lb. capacity Keeler D-K Package Units to supply major auto producer's steam requirements

The four large package steam generators above are shown just outside the recently completed KEELER package unit assembly plant, ready for shipment to a major automobile manufacturer.

Oil-fired, each of these KEELER D-K steam generators have a capacity of 50,000-lbs. of steam per hour at a maximum design pressure of 200 psi. They were selected for their ability to efficiently supply a more flexible steam load in the purchaser's heat and process requirements. The complete package includes all burning equipment, controls, safety devices and accessories—ready for quick hook-up and operation.

KEELER water tube steam generators of various types and sizes are serving this user in several plants throughout the country. Satisfaction with previous installations and the KEELER reputation as a builder of better boilers since 1864 led to this repeat order.

Type D-K KEELER package steam generators are compact package power plants, made in oil or gas fired units with capacities up to 60,000-lbs. of steam per hour. Standard design pressures range from 200 to 500 psi. They incorporate the popular D-type tube arrangement in a completely steel encased package, with water cooled and insulated furnace sides, roof and floor as well as front and rear walls.

Write for illustrated bulletin containing full specifications on these compact Package Power Plants.

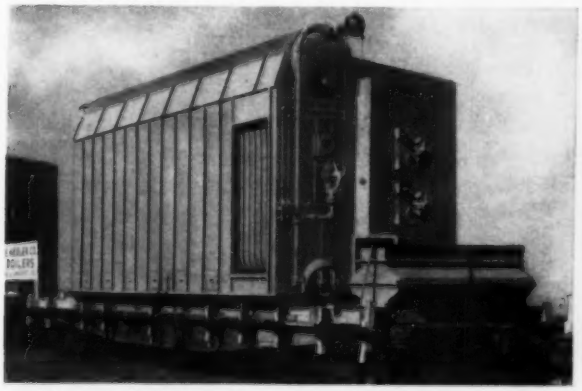
E. KEELER COMPANY

100-200 West St. Williamsport, Penna.

ESTABLISHED 1864

The Seal of Quality in Water Tube Steam Generators

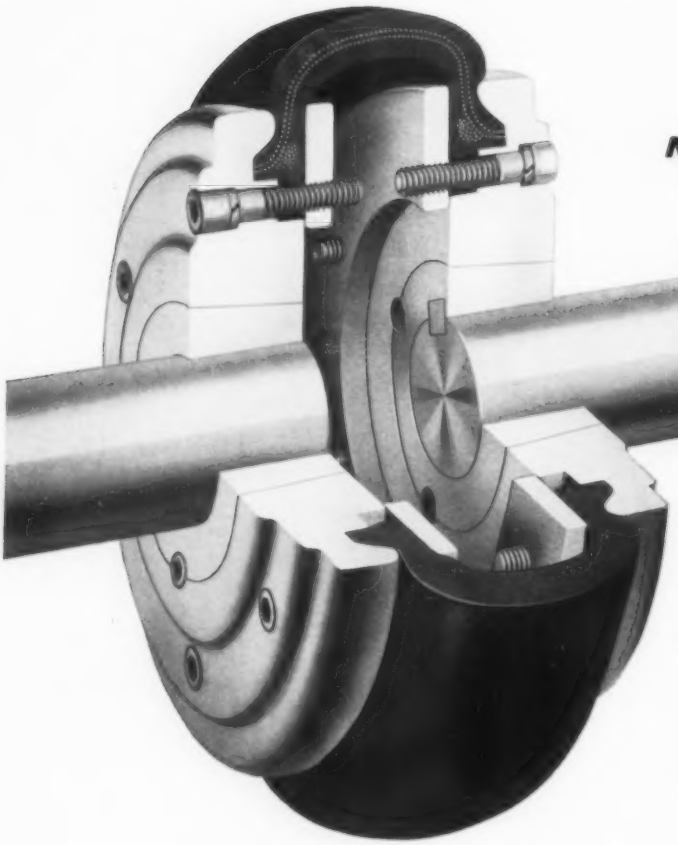
KEELER WATER TUBE *Boilers*



"Front end" closeup view shows side gas outlet; burners mounted on wind box; and soot blowers piped to the main control valve on the D-K's steam drum.

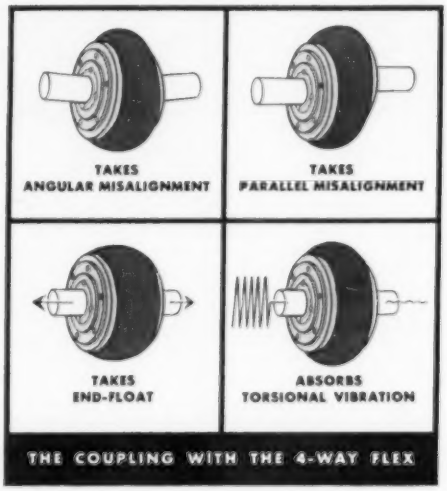
Interior view of new Keeler assembly shop shows D-K units in various stages of completion. D-type tube arrangement can be seen in the foreground unit.

For more data circle 526 on Post Card



NEW!

DIFFERENT!



DODGE

Para-flex

FLEXIBLE CUSHION COUPLING

THIS coupling "swallows up" shaft misplacements. It automatically compensates for end-float, parallel misalignment, angular misalignment *or any combination of all three.* Moreover, it cushions the stresses of shock loads. And it absorbs torsional vibration—reducing noise and protecting machinery from vibration's destructive forces.

Here is a new type of performance—made possible by the development of a tire-like flexing element. Synthetic tension members, bonded together in rubber, give this element the stamina and dependability of modern, high-speed, high-load, shock-absorbing truck tires—and the ability to respond magically to all manner of changing shaft conditions.

Para-flex takes minimum space on the shaft. Mounting is simplified through the use of standard Taper-Lock bushings—no reboring, no machining. Safety is promoted by flush design; there are no protruding parts. No lubrication is required, no periodic inspection. And since the flexible member is molded with a transverse split, it can be replaced *without moving either the driver or driven machine.*

Para-flex Couplings are stocked by Dodge Distributors in popular transmission sizes. They are available from factory stock in capacities up to 825 hp at 1200 rpm. Call your distributor for early delivery to *make your own test.* You'll witness something revolutionary!

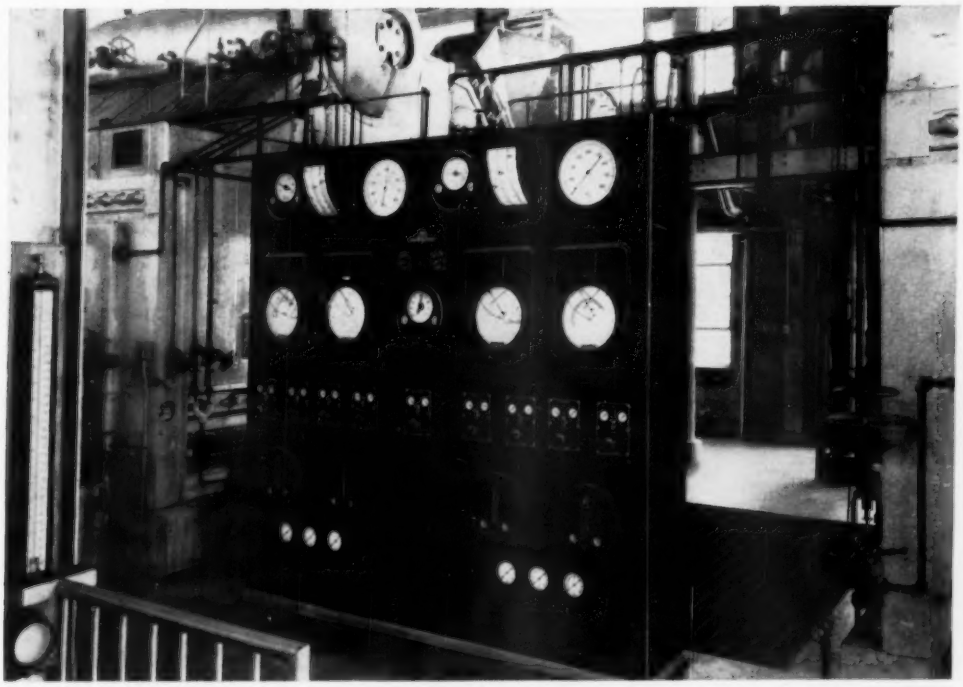
DODGE MANUFACTURING CORPORATION, 6400 Union, Mishawaka Ind.

DODGE

of Mishawaka, Ind.

CALL THE TRANSMISSIONEER—your local Dodge Distributor. Factory trained by Dodge, he can give you valuable help on new, cost-saving methods. Look in the *white* pages of your telephone directory for "Dodge Transmissioneer."

For more data circle 527 on Post Card



Bailey Meters and Controls for two boilers in a midwestern milling company.

How Bailey helps you get a new boiler off to a fast, safe start——

--The thrill of putting a new boiler "on-the-line" can be marred if you lack adequate metering and control equipment. You are a lot surer of a fast, safe start and dependable operation for a long time when you specify Bailey Meters and Controls. They are keys to peak efficiency and low operating costs.

Bailey is the choice of virtually all the most efficient plants on the Federal Power Commission's heat rate report. Here's why:

1. A Complete Line of Equipment

You can be sure a Bailey Engineer will offer the right combination of equipment to fit your needs. Bailey manufactures a complete line of standard, compatible pneumatic and electric metering and control equipment that has proved itself. Thousands of successful installations involving problems in measurement, combustion, and automatic control are your assurance of the best possible system.

2. Experience

Bailey Engineers have been making steam plants work more efficiently for more than forty years. Veteran engineer and young engineer alike, the men who represent Bailey, are storehouses of knowledge on measurement and control. They are up-to-the-minute on the latest developments that can be applied to your problem.

3. Sales and Service Convenient to You

There's a Bailey District Office or Resident Engineer close to you. Check your phone book for expert engineering counsel on your steam plant control problems.

A131-1

BAILEY METERS

Instruments and controls for power and process

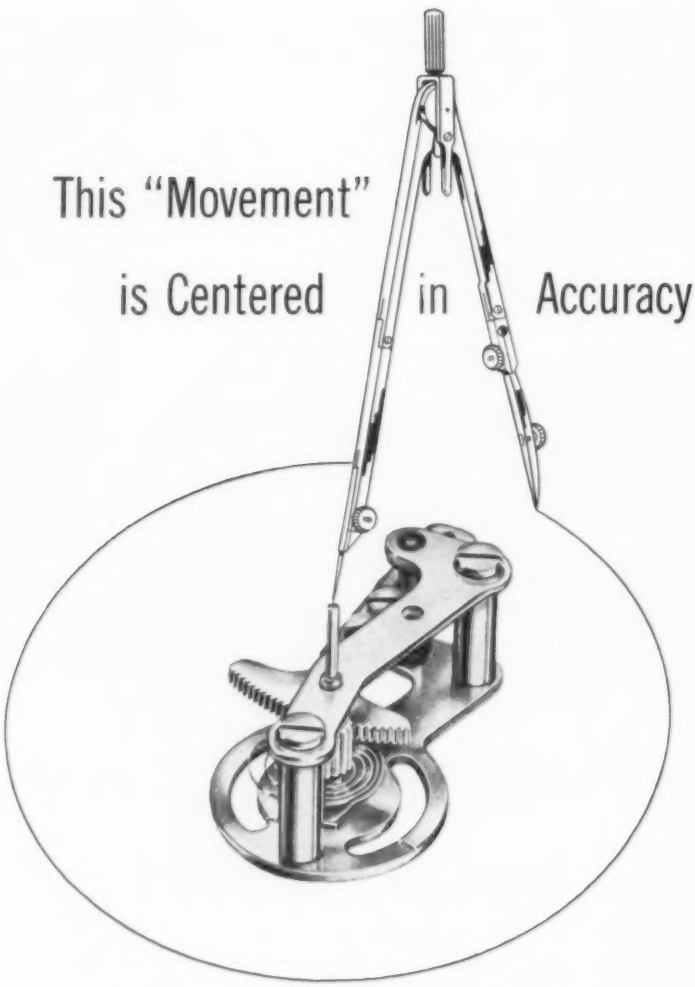
BAILEY METER COMPANY

1040 IVANHOE ROAD • CLEVELAND 10, OHIO

In Canada—Bailey Meter Company Limited, Montreal

For more data circle 528 on Post Card

This "Movement" is Centered in Accuracy



The rotary movement in Ashcroft Duragauges has a geared center shaft on which the pointer is mounted. When pressure flexes the Bourdon tube, the pointer is always positively positioned. You can rely on the Duragauge for precise accuracy in measuring pressure no matter how severe the conditions of service.

Correct calibration is guaranteed: the one-piece link between movement and Bourdon tube prevents slippage or parting under tension. Recalibration is easy from front or rear. Universal adjustability permits uniformly graduated dials.

You can order Ashcroft Duragauges with all-stainless-steel movement or stainless steel with nylon bearings and pinion gear. A complete choice of Bourdon tube materials, pressure ranges, dial sizes and case designs and materials is available. Your industrial supply distributor will gladly help you select the best combination for your requirements. So, be certain of highest sustained accuracy, durability and economy – specify Ashcroft Duragauges.

Ashcroft Duragauge in Alumalife® case—a lifetime case made of special aluminum alloy.

MAXWELL MANNING M&M & MOORE INC. TRADE MARK

G1-58

ASHCROFT PRESSURE GAUGES

A product of

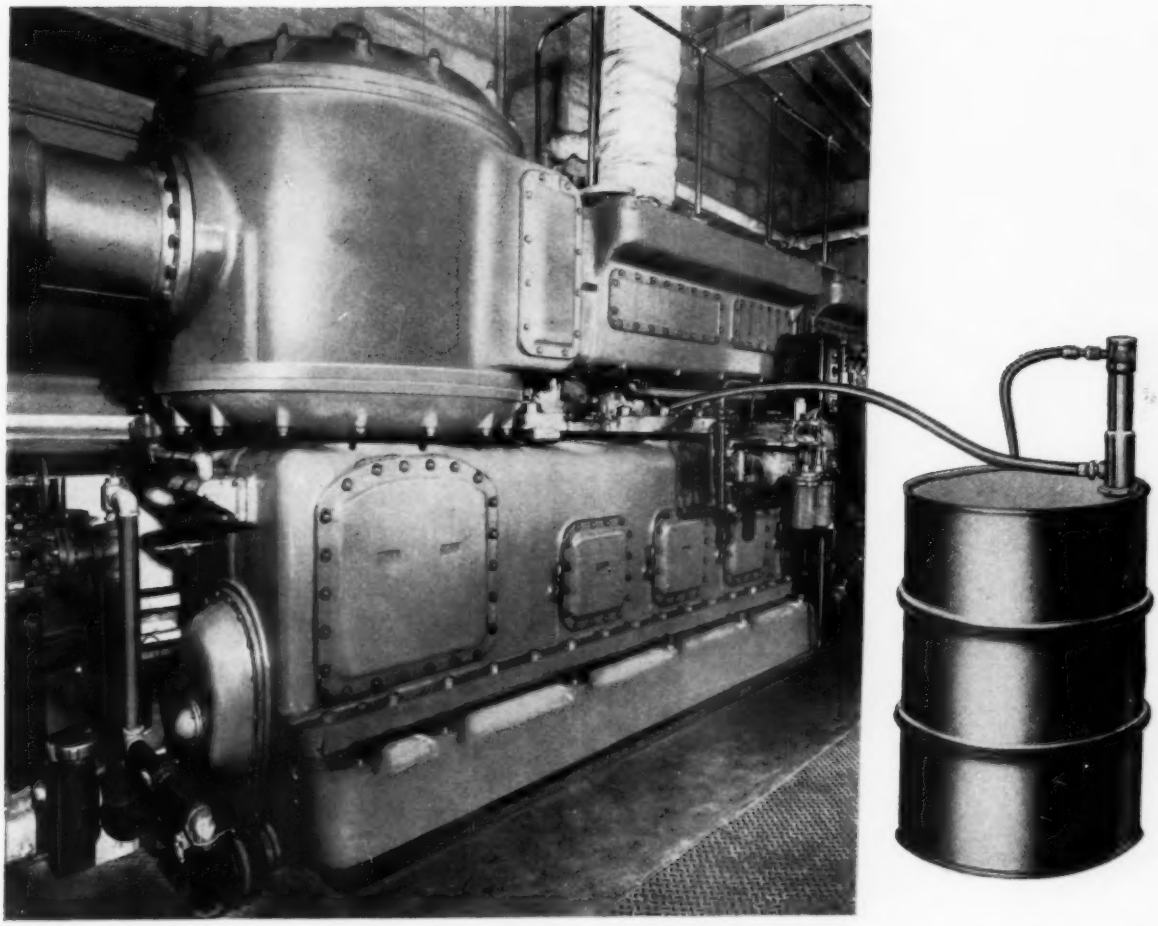
MANNING, MAXWELL & MOORE, INC.

Consolidated Ashcroft Hancock Division • Stratford, Connecticut

In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario

For more data circle 529 on Post Card

Varnish Problem Vanishes!



Stop the formation of harmful **varnish**, sludge and carbon in your Diesels and *keep it stopped* with Sinclair RUBILENE® or RUBILENE HD, the high viscosity index oils proved by over 35 years in industrial Diesel applications. RUBILENE earns its reputation by its performance under continuous operation and heavy loads. It fights deposits and gives better protection to cylinders, pistons, rings and other vital moving parts. Your Diesel stays on the job longer . . . service time is cut 'way 'way down.

Let RUBILENE help solve *your* lubrication problems. Regardless of the make of your Diesel, there's a member of Sinclair's RUBILENE or RUBILENE HD family that meets your requirements. Call your local Sinclair Representative for further information, or write for free literature to: Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N. Y. *There's no obligation!*

Dino, the Sinclair Dinosaur, says:

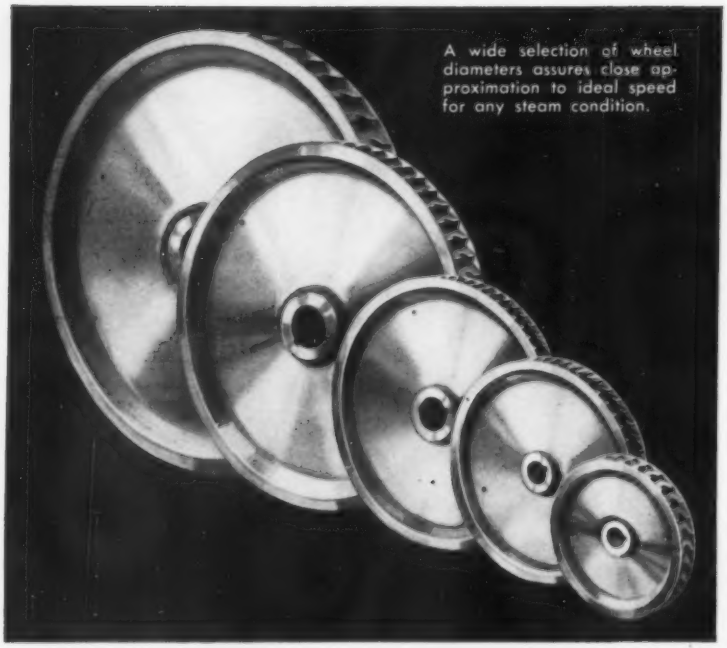
"Send *now* for free literature on RUBILENE!"

SINCLAIR RUBILENE® OILS

For more data circle 530 on Post Card

There's a TERRY wheel turbine to meet your specific needs!

SOLID-WHEEL DURABILITY COMES IN ALL SIZES...



up to 2000 HP

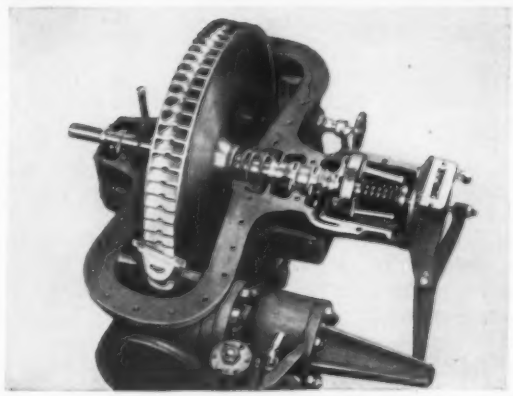
Wherever you need dependable turbine drive up to 2000 HP—and strength and durability are major factors—Terry solid-wheel turbines are specifically equipped for the job. For, within their simple, sturdy casing is a rugged one-piece wheel.

You choose from a broad selection of sizes for all mechanical drive applications—with each Terry wheel turbine accurately proportioned to fit the operating conditions. From the smallest to the largest, these rugged turbines have:

- Solid one-piece wheel.
- Large radial and axial clearances.
- Double rim protected blading.
- Individual nozzle control.
- Dependable and durable governor.
- Heavy dust-proof bearing and governor housing.
- Independent overspeed trip with separate valve.
- Sturdy casing design.
- Strong and easily inspected steam strainer.
- Truly accessible construction, which makes inspection of the interior parts a simple matter.

For full details, send for a copy of bulletin S-116.

THE TERRY STEAM TURBINE CO.
TERRY SQUARE, HARTFORD 1, CONN.



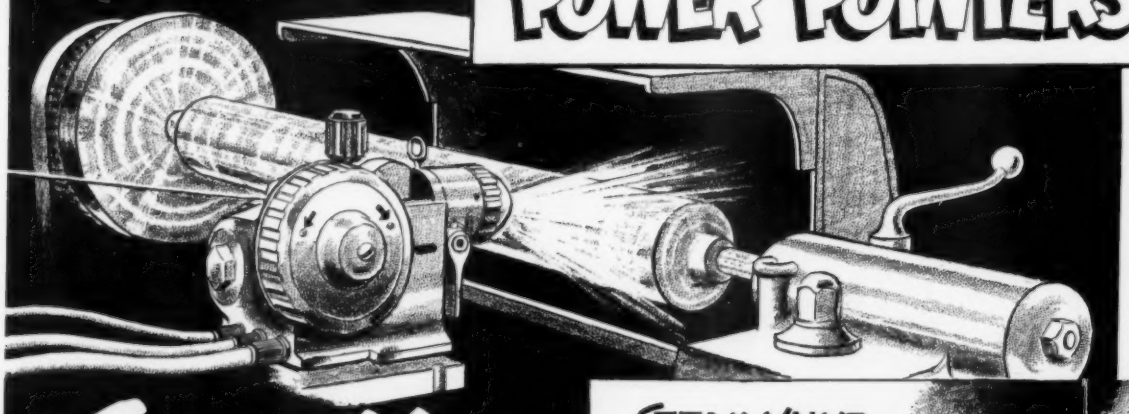
Terry wheel turbine with cover removed to show the solid wheel. There are no separate parts to loosen or work out. Blade clearances are generous.

TERRY

TT-1208

For more data circle 531 on Post Card

POWER POINTERS

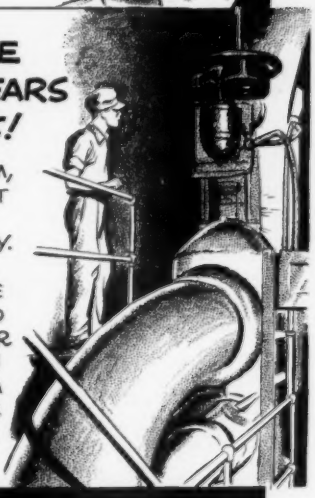


Sprays Monel

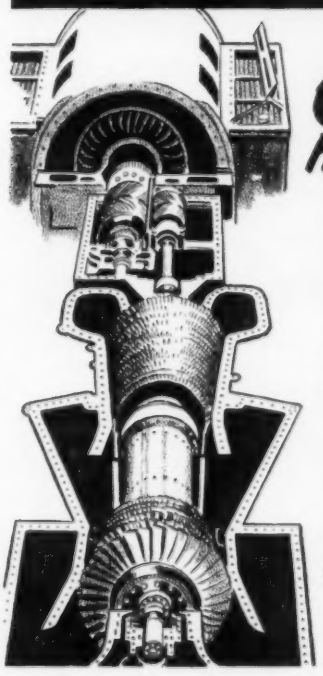
...stops rust-cutting of carbon seals

GLAND SECTIONS OF SHAFTS FOR SMALL MARINE STEAM TURBINES ARE NOW BEING SPRAYED WITH MONEL NICKEL-COPPER ALLOY FROM SPRAY GUNS THAT MELT AND BLAST DROPLETS OF METAL AGAINST THE SHAFTS. BY PREVENTING ROUGHENING OF THE SHAFT THE MONEL* ALLOY COATING HELPS MAINTAIN THE STEAM SEAL ...PREVENTS STEAM LEAKAGE AND RESULTING OIL CONTAMINATION.

STEAM VALVE SERVES 27 YEARS ...NO REPAIRS!



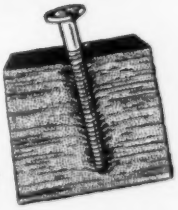
ITS SECRET: THE STEM, SEAT RINGS AND SEAT ARE MONEL NICKEL-COPPER ALLOY. MOTOR ACTUATED, THIS TROUBLE-FREE VALVE HAS RESISTED MORE THAN A QUARTER CENTURY OF EROSION AND CORROSION ON A MAIN STEAM HEADER OPERATED AT 350 PSI AND 700° F.



6,000 hours young

AFTER 6,000 HOURS' SERVICE, TURBINE BLADES, OPERATING AT RIFLE BULLET SPEED (1,200 FT/SEC.) AND AT RED HEAT (1,300-1,350°F. INLET TEMPERATURE) LOOKED AS THOUGH THEY HAD NOT BEEN USED AT ALL. FORGED FROM INCONEL* "X" AGE-HARDENABLE NICKEL-CHROMIUM ALLOY, THESE AND SIMILAR BLADES RESIST CREEP AND EXTREME OXIDIZING CONDITIONS MET IN INDUSTRIAL GAS TURBINES.

These nails are all "drive" and no backing out



ANNULAR GROOVES IN STRONG ANCHORFAST* MONEL NICKEL-COPPER ALLOY NAILS FORCE WOOD FIBERS TO SERVE AS WEDGES THAT LOCK INTO THE GROOVES AND PREVENT THE NAILS FROM BACKING OUT. IN COOLING TOWER SERVICE, THE GROOVES STAY SHARP AND EFFICIENT BECAUSE MONEL ALLOY RESISTS RUST AND CORROSION AND LOUVRES STAY PUT.

UP AGAINST A METAL PROBLEM?

THERE'S A GOOD CHANCE THAT INCO'S MECHANICAL ENGINEERING SECTION HAS SOLVED A SIMILAR ONE OR COME CLOSE ENOUGH TO IT TO SUGGEST A GOOD ANSWER. JUST LET US KNOW THE DETAILS.

THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall Street — New York 5, N. Y.

INCO Nickel Alloys

*Registered trademark

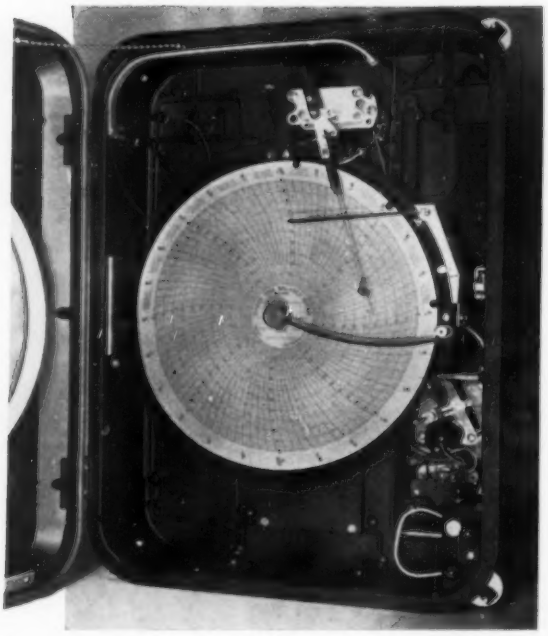
For more data circle 532 on Post Card

RING BALANCE FEATURES No. 4

ELECTRIC TRANSMISSION

with the versatile new PowrLog

ELECTRONIC RECEIVER



Complete assembly with amplifier in place. Flow integrator may be added for complete records.

The Hagan PowrLog Electronic Receiver brings a new standard of accuracy and dependability to the remote transmission of all standard variables. In applications where the transmitter is a Ring Balance meter equipped with slide wire, the PowrLog receiver can record, integrate and indicate fluid flow with or without compensation for pressure and temperature, fluid density, liquid level in open or closed vessels, boiler drum water level. Used with suitable amplifiers, the field of application widens to include temperature, heat exchange and other variables.

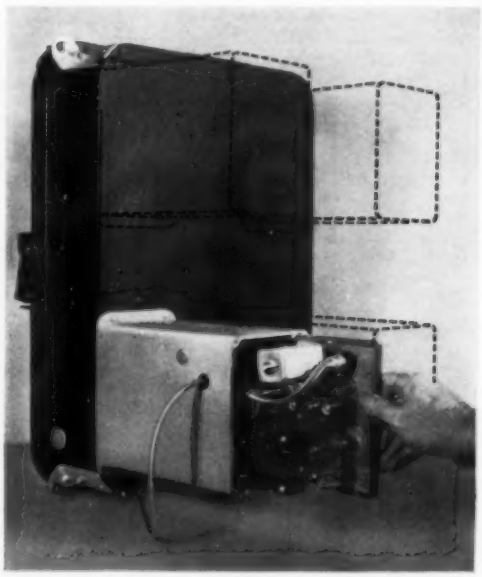
Interchangeable, plug-in, input boxes quickly adapt the PowrLog to operation with AC or DC inputs. Up to four records can be made simultaneously or control can be accomplished through coupling to the Ring Balance pneumatic transmitter-controller.

Unaffected by mechanical friction or power supply fluctuations, the PowrLog offers these operating characteristics:

Resolution	0.15% of full scale
Repeatability	0.25% full scale
Over-all Accuracy	0.5% full scale
Pen Travel Time	2 seconds full scale (0.5 sec./inch)

Input Ranges:

AC Bridge	1000 ohm transmission potentiometer
DC Potentiometer	0-0.1 v. to 0-1.3 v.
DC Voltmeter	500 volts maximum



Printed circuit amplifier chassis slides readily into housing. Note that as many as four units may be used in a single instrument case.

Remember, the Hagan Ring Balance meter offers you all these features, too:

1. Ease of calibration under operating static pressures with factory calibrated check weights matched to each meter. No more four-story water columns and telephones!
2. Safe operation with rings rated at 2,500, 6,000, 15,000 psig. No gaskets, no stuffing boxes.
3. Sealing fluid density and level not critical. No eyedroppers required to maintain calibration.
4. Interchangeable ring assemblies for full scale ranges from 0.5" w.c. to 560" w.c. Adjustment on any one ring over a 7:1 differential range easily and quickly accomplished.
5. Wide range computation and/or compensation by means of built-in, easily checked mechanisms available on most models.
6. Any Ring Balance meter can be equipped with slide wire for operation with data-logging devices and for transmission to the PowrLog.

For full details on the Hagan PowrLog, write for Bulletin MSP 149.

HAGAN CHEMICALS & CONTROLS, INC.

HAGAN BUILDING, PITTSBURGH 30, PENNSYLVANIA
DIVISIONS: CALGON COMPANY, HALL LABORATORIES
IN CANADA: HAGAN CORPORATION (CANADA) LIMITED, TORONTO

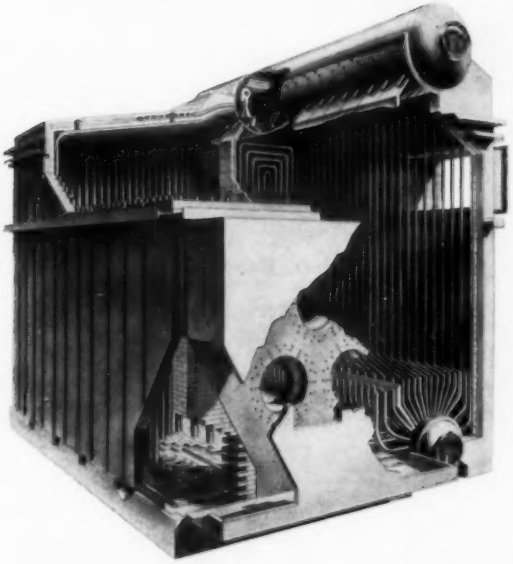
For more data circle 533 on Post Card

Here's why you get

IMPORTANT SAVINGS in

- ✔ *first cost*
- ✔ *installation*
- ✔ *operation*
- ✔ *maintenance*

with the FW Series "SC" STANDARD BOILER

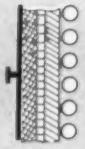


THESE nine Foster Wheeler design features add up to substantial savings in the cost of steam generation. Equally important is the extra *dependability* that's built into every "SC" unit — the result of over 60 years of experience in the design and construction of large, high-pressure steam generators for leading central station power plants.

Pre-engineered in all details and standardized for economy, these FW standard steam generators are available for oil or gas firing, in capacities from 50,000 to 150,000 lb/hr, for pressures to 1500 psi and superheated steam temperatures to 950 F. For complete information, send for Bulletin B-55-4. *Foster Wheeler Corporation, 666 Fifth Ave., New York 19, N.Y.*

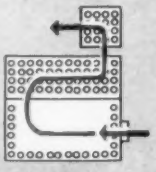
1. COMPLETELY WATER-COOLED WALLS

All furnace walls are cooled by closely-spaced tubes, minimizing setting maintenance and preventing excessive exit gas temperatures.



2. EFFICIENT FIRING ARRANGEMENT

Burner arrangement assures maximum rating without overheating furnace tubes. Rear wall is over 39 ft. from burner wall, permitting long, horizontal flame travel.



3. FULLY DRAINABLE SUPERHEATER

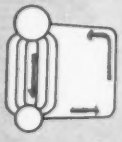
A completely drainable superheater permits removal of all condensed water from the elements before start-up.

4. HIGH STEAM PURITY

The normal drum internals consist of chevron dryers and a dry box. Separators may be added which make possible a steam purity of 1PPM or less.

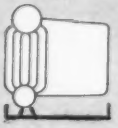
5. UNRESTRICTED CIRCULATION

Absence of headers provides free circulation through integral risers and downcomers, eliminating header handhole plates and gaskets.



6. BOTTOM SUPPORTED UNIT

The bottom-supported design fully utilizes the structural strength of the tubes and provides low unit stresses in all members.

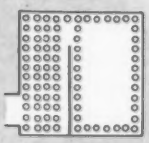


7. PRESSURE-TIGHT CASING

The all-welded casing forms a rigid, pressure-tight unit that can be arranged for pressurized or balanced draft operation.

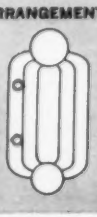
8. MINIMUM REFRACTORY BAFFLING

The wall separating furnace and boiler bank is the only refractory baffling used. It is completely accessible from the furnace.



9. SIMPLE SOOT BLOWER ARRANGEMENT

Soot blowers are supported on the outer row of boiler-bank tubes, simplifying alignment and providing easy access.



FOSTER WHEELER

NEW YORK • LONDON • PARIS • ST. CATHARINES, ONT.

For more data circle 534 on Post Card

LET'S TALK STEAM...

Below is a Vibra-Grate Stoker at work! . . . helping produce steam at lowest possible cost per pound. Look how evenly fuel is distributed in the bed — no holes, no light spots to cut down combustion efficiency!

Vibra-Grate feeds and moves wet or dry fuel automatically by intermittent vibrating motion. It is water-cooled to give you longer grate life and minimum maintenance.

You will also find that the AE Vibra-Grate Stoker gives you freedom from smoke at both high and low ratings . . . eliminates need for dust collectors and cinder return systems . . . will burn low-grade coals efficiently . . . continuously and automatically discharges ash . . . can burn gas or oil singly, or in combination with coal.

Vibra-Grate is built for efficiency. It is many years ahead of all others in design and performance. If you are modernizing or considering a new power plant, it will pay you to find out more about Vibra-Grate. Just write to American Engineering Company.

OTHER OUTSTANDING AE-DESIGNED STOKERS

Perfect Spread Stoker: gives maximum combustion efficiency at lowest cost per pound of steam, REGARDLESS OF QUANTITY OF FUEL USED! Feeders have spiral-type rotors for lateral and longitudinal coal distribution.

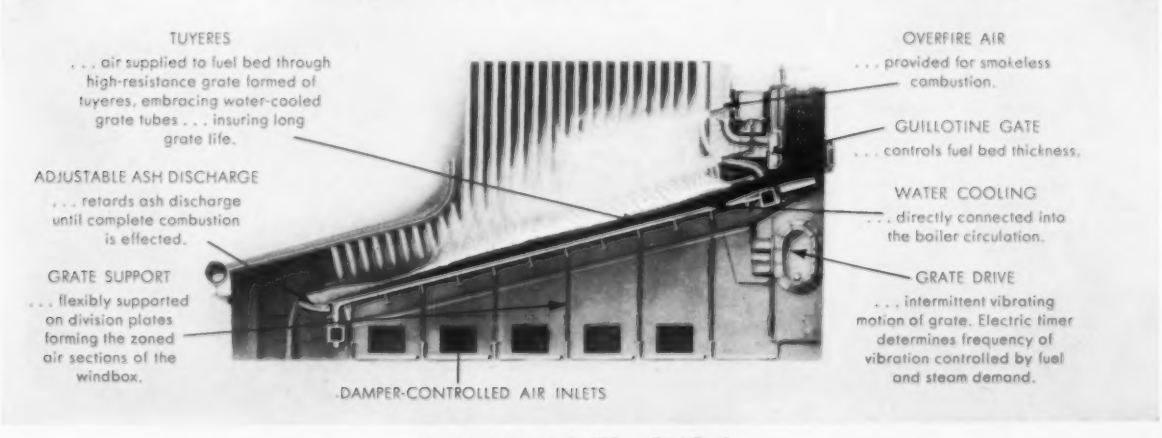
Taylor Stoker, Type "H": low-cost steam for moderate-sized plants. The same underfeed principle of combustion in high-capacity stokers for large central stations and industrial plants.

Taylor Stoker, Type "R": for power requirements ranging from 20,000 to 500,000 pounds of steam per hour. A completely self-contained unit . . . quick-firing . . . with adequate reserve capacity.

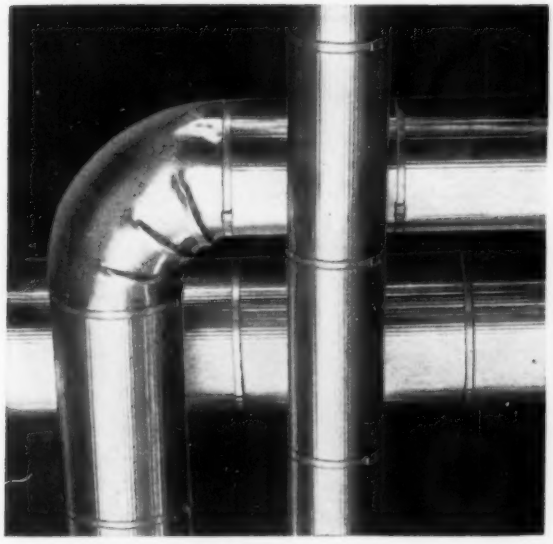
AMERICAN ENGINEERING COMPANY
Wheatsheaf Lane & Sepviva Street, Philadelphia 37, Penna.

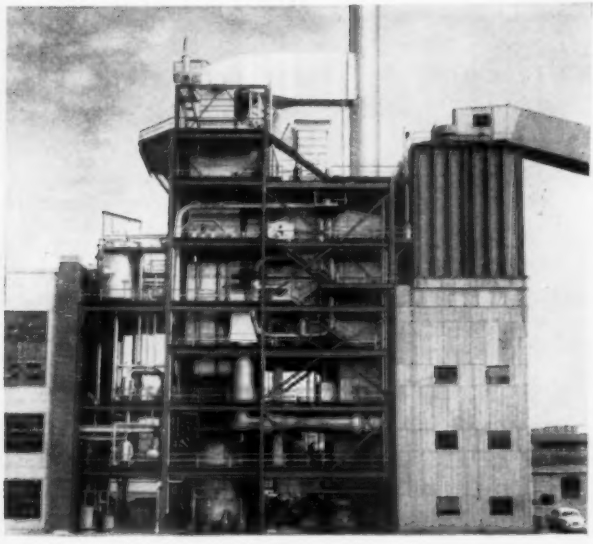
Canadian Subsidiaries: Affiliated Engineering Corporations, Ltd., Montreal, P. Q. Bawden Industries Ltd., Toronto, Ont.

8-101


TUYERES
. . . air supplied to fuel bed through high-resistance grate formed of tuyeres, embracing water-cooled grate tubes . . . insuring long grate life.
ADJUSTABLE ASH DISCHARGE
. . . retards ash discharge until complete combustion is effected.
GRATE SUPPORT
. . . flexibly supported on division plates forming the zoned air sections of the windbox.
OVERFIRE AIR
. . . provided for smokeless combustion.
GUILLOTINE GATE
. . . controls fuel bed thickness.
WATER COOLING
. . . directly connected into the boiler circulation.
GRATE DRIVE
. . . intermittent vibrating motion of grate. Electric timer determines frequency of vibration controlled by fuel and steam demand.
DAMPER-CONTROLLED AIR INLETS

For more data circle 535 on Post Card





Childers Jacketing Protects Insulated Lines, Decreases Heat Loss, Improves Appearance:

Maintenance-free Childers Jacketing goes on fast and easy . . . never needs painting . . . gives steam lines the well-dressed look that good housekeeping demands.

Insulation lasts far longer, say leading power plant engineers, when protected with Childers Aluminum Jacketing. Costly maintenance and repairs to insulation are reduced, and insulation is protected against damage from workmen, moving equipment and dripping fluids like oil and grease.

Heat lost by radiation is reduced, too, when Childers Jacketing is installed on power plant lines and equipment. The improved efficiency of the insulation decreases fuel consumption. Fewer BTU's are lost per KWH.

Tight, positive protection and weatherproofing of insulation is assured by exclusive Childers Lap-Seal (patents pending). This feature takes the guess-work out of jacketing laps—speeds installation, saves labor while giving a superior seal.

Greater strength at less cost is yours with Childers Cross-Crimp®. Tests prove the rolled-in 3/16" cross corrugation increases the vertical strength and rigidity of .016" thick aluminum to that of plain .024" thick aluminum. Jacketing costs are consequently reduced as much as ⅓ when Childers Jacketing is used instead of ordinary sheet aluminum.

You can complete the installation of neat, maintenance-free aluminum over every square foot of valuable insulation by using new Childers Ell-Jacs. These two-piece aluminum covers are available for insulated elbows up to 16" o.d., including insulation thickness. For larger elbows, regular roll jacketing is easily mitered on the job and applied.

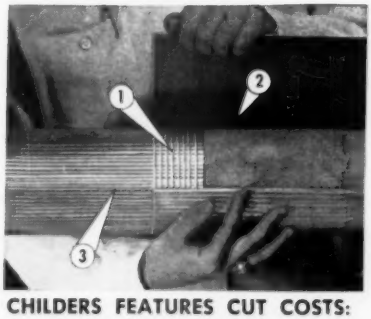
First cost is less for Childers Jacketing and Ell-Jacs than for any other permanent-type protection—even less than some temporary coverings which require constant maintenance, repair and replacement.

Installation is easy. Two men can do the job. Best method of attaching jacketing is with aluminum strapping and seals. Only pliers and screwdriver are needed. Childers Ell-Jacs are applied with aluminum sheet metal screws. Jacketing and Ell-Jacs can be removed to inspect lines, then reapplied without waste.

Engineering Representatives in 27 cities provide technical information and assistance on protection of insulated lines, elbows, towers, vessels, tanks. Only Childers has this nationwide service organization.

For a free sample of Childers Jacketing, with engineering data on how to safeguard your insulation, write to: Childers Manufacturing Co., P. O. Box 7467, Dept. PE-1, Houston 8, Texas.

In Canada, write direct to Peerless Mfg. Co., Sub-Post Office 28, Calgary, Alberta.



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Only Childers makes available to you complete specifications and engineering data on aluminum jacketing in these catalogs: Sweet's Industrial Construction File pp. 6b/Ch; Chemical Engineering Catalog pp. 530a-d; Refinery Catalog pp. 341-4.

For more data circle 536 on Post Card

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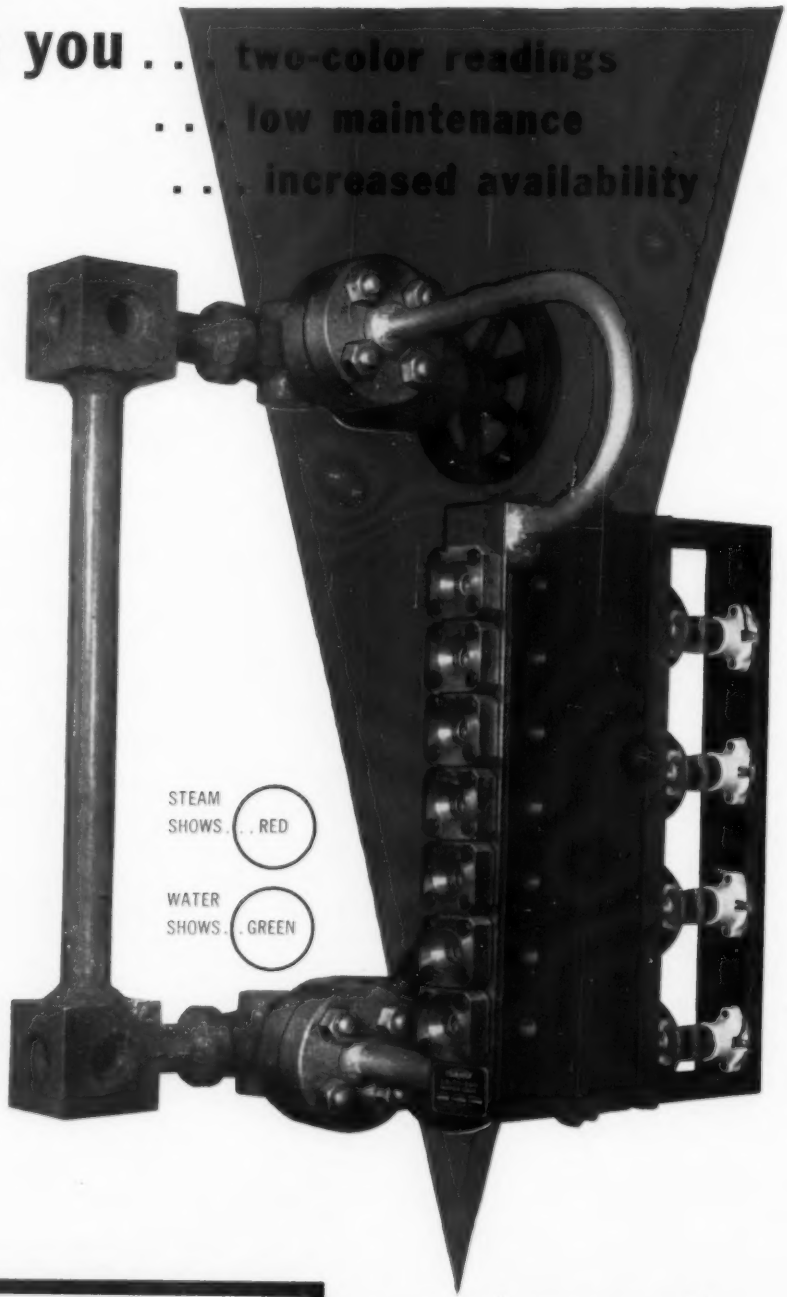
Increased availability means longer service life. Cover glass assemblies can be *serviced in place*, easily and quickly.



Yarway Bulletin WG-1814 describes the Color-Port Gage. Write for it.

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YARWAY COLOR-PORT . . . *a good way to specify high pressure water gages*

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TRACERS

Power Engineering's Monthly Probe of Power Facts

Low-pressure rather than h-p h-t units may turn out to be the prototypes for tomorrow's commercial atomic power plants. This is the opinion of Paul R. Rasten and Murray W. Rosenthal of Oak Ridge National Laboratory. They point out that because nuclear fuel is relatively cheap, it may not be economical to build h-p steam systems in order to secure high fuel efficiency. Also, in some cases, high temperatures cause the fuel to expand or "diffuse," slowing the rate at which non-fissionable parts of the fuel are made fissionable.

New a-c to d-c device has appeared which can vary the amount of work done by the d-c output. It's General Electric's silicon controlled rectifier — a tiny device with almost unlimited life and very high efficiency ratings in circuits. Combining the feature of a conventional semiconductor and a high speed power switch, it seems destined for a revolutionary role in electrical circuitry. How does it work? See the article on page 86 of this issue.

National Bureau of Standards has recently extended the temperature range in which pH standards are certified. Formerly the pH scale was accurately determined only between 0 deg and 60 C (140 F). Now standard pH samples are available from 0 deg to 95 C (203 F).

There's a new mild steel iron powder type of electrode which deposits weld metal at the rate of 17 lb per hr (100 per cent work factor). This rate is said to be the fastest ever approached by a "stick" electrode. It's done by using an extra heavy iron powder coating, and increased machine settings. Air Reduction Co is the developer.

As a result of analysis of recent cases of rotor failure, Westinghouse is restricting use of nickel-chromium-molybdenum-vanadium steel to rotors where the metal temperature is 900 F or less, and has reduced allowable stress in the temperature bracket between 800 and 900 F. For other new concepts of rotor design, see the report on page 77.

Fast, new technique to measure exact stresses in piping under high pressures and high temperatures has been developed by John W. Soule of Philadelphia, a mechanical design engineer with United Engineers & Constructors. Soule's mathematical technique makes application of electrical laws practical for the first time to mechanical problems in piping systems. It is used to analyze stresses in piping for power plants, refineries, chemical plants before piping is installed. Soule described the method at a recent ASME meeting at Hartford, Conn.

Incinerator plant newly built at Oyster Bay, N. Y., incorporates a number of innovations. Ash-removal system, especially, is noteworthy. It's an enclosed hydraulic sluiceway into which the ashes fall directly from the furnace, are quenched and carried by water to a large underground ash tank and stored there under water. To see what happens next, turn to page 67.

Fig. 1. Seventeen buildings, most of them high-rise apartments, are included in the Cabrini Homes public housing extension just north and west of Chicago's Loop. Arrow indicates central boiler plant. Row houses at upper right are original project

Radiant Heating for 1900 Homes

By ANTHONY G. RATKUS *

WHEN the Chicago Housing Authority settled on plans for a big new extension to its Frances Cabrini Homes project just north and west of the downtown city, radiant heating won out as the best calculated type of installation for the job. The extension includes 17 buildings in all, most of them high-rise structures, with some 1921 apartment units. This represents close to 2,000,000 square feet of floor area, which doubtless makes the Cabrini radiant heating system the largest installation of its type. William Goodman of Chicago designed the mechanical systems for this project.

In selecting radiant heat provided by hot water distributed from a central boiler plant, the Authority was guided by these major reasons: such a system, using copper tubing in the concrete floor and ceiling slabs of each apartment, would mean minimum maintenance and simplification as compared with a hot water or steam system using radiators or convectors; it would also not encroach on living space necessarily planned at minimum dimensions; the low pressure boiler system would mean lower initial cost and lower operating cost.

Last and most important: with the radiant heating system requiring water at a maximum temperature of only 130 F, circulating water could be supplied from the low pressure boilers at a temperature of 220 F. Consequently, the water circulated from the boiler house to the various buildings could take a 90-deg drop with a resulting large saving in the size and cost of the underground piping system, and in the cost of electricity for circulating this water. This 90-deg drop is comparable to those used with high temperature, high pressure hot water heating systems.

As things turned out, CHA has found that with a job of this size, the per dwelling-unit initial cost of the radiant heating system equipment has been less than it would have been for any other system. As for actual operating costs — it is still too early to get the full story, since the last of the 17 buildings are just now being completed and were scheduled to go on the line this month.

In general the Heating, Ventilating, Air Conditioning Guide was used as the basis for general design. Outside temperature of minus 10 F and inside room temperature of 70 F in each dwelling unit were used as the design conditions.

The central heating boiler plant consists of six low pressure, Scotch-marine hot water boilers in a separate boiler house. The boilers supply water to the underground distribution system at a temperature of 220 F. This hot water transfers its heat to converters located at each building machine room. The heated water in the converters (radiant system) is then circulated within the building. The hot water return to the boiler house is designed to return at 130 F. Each one of these systems, the distribution and radiant, is complete with its own expansion tank, pumps, water make-up.

Since No. 6 oil was justified as the fuel, the boilers chosen were Scotch-marine wet back with hot vertical surfaces of rear head backed by water with no rear refractory. The boilers were designed in accord with ASME code with a working pressure of 30 psi gage. Each boiler has a heating surface of 3500 sq ft with a furnace volume of 440 cu ft.

Boiler units include air induced draft fan which delivers 12,300 cfm against 2.4 in. of static pressure with standard air. The motor has a speed of 1750 rpm, is a 5-hp, 208-v, 3-phase unit.

Fuel oil burners on the main boilers are the rotary-type, burn No. 6 oil and are capable of developing at least 560 boiler hp. The total capacity of all burners operating simultaneously exceeds 3360 boiler hp. The oil valves are linked with the primary and secondary air dampers, which permits swinging the burner open for inspection without disconnecting the linkage or wiring for the burner motor. The oil and gas valves are set so that they cannot open while the burner is in the "swung away" position.

Six storage tanks for fuel oil are steel, 10 ft 6 in. in diameter by 47 ft long. This gives a storage of 30,000 gal at each tank and a total storage capacity of 180,000 gal. This means that during the normal winter months the full oil storage has sufficient capacity for several weeks.

Fuel oil system is so designed that each boiler has a burner, pump, heater, storage tank and interconnecting piping and is a complete unit. There are no cross-connections with the other burner systems and tanks for other boilers.

*Mechanical Engineer with the U. S. Public Housing Administration

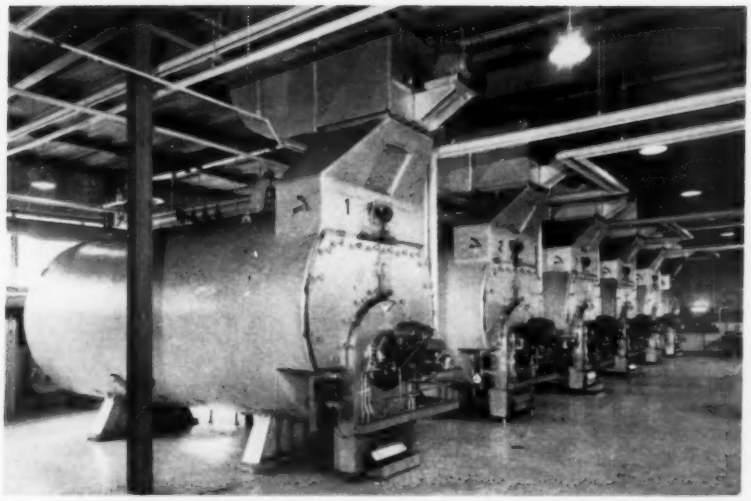


Fig. 2. View of the boiler room, with its line of six Scotch-marine units. Fuel is No. 6 oil, burners are rotary-type. The boilers have a working pressure of 30 psi

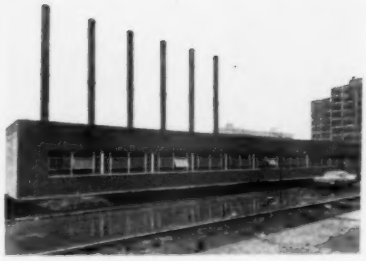


Fig. 3. Boiler house includes big shop space, can be expanded at north end

From This Central Plant

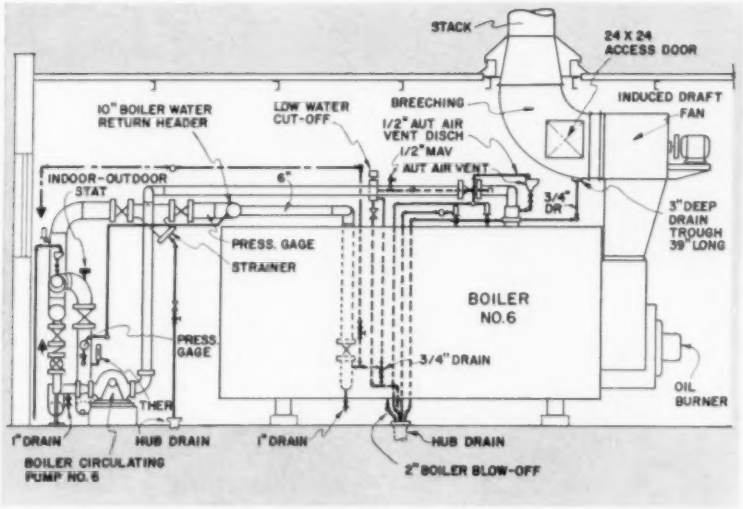


Fig. 5. Cross-section of one of the boilers. Each boiler has its own fuel system, heating surface of 3500 sq ft

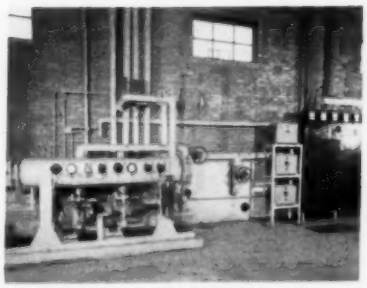


Fig. 4. Portion of control aisle across from boiler line, showing panel and one of the converters for heating fuel

Oil flow for each system follows this specific route. Each fuel oil pump picks up the oil from the bottom of the hot well in the tank and discharges to the associated burner. The excess oil from the burners returns to the hot well in the tank. The relief valve on the discharge line of the fuel pump is connected to the oil return line which is routed back to the vented fuel oil tank.

Fuel oil pumps at the burners are designed for just one burner. Each burner when operating requires operation just on its associated pump. Each pump delivers a minimum of 280 gph against a total head of the system. The motor is a 3-hp, 208-v unit.

To heat the fuel oil converters, a steam boiler has been provided in the boiler house. It is a gas-fired, fully automatic unit and operates at 15 psi and has a capacity of 685 mbh (million Btu per hr) output, with 855 mbh input.

Heater (or converters) heats a minimum of 280 gal of fuel oil per hour from 90 F to 200 F with steam at 10 psig. Fuel oil is in the tubes and steam in the shell and around the tubes. The minimum heating surface in the heater is 106 sq ft. Maximum pressure drop of the oil flowing through this heater does not exceed 5 psi.

Oil unloading pump has the piping so designed with shut-off valves and by-passes that it may be used if required for unloading oil from delivery trucks into any one of the six tanks, or pumping out any one of the tanks and discharging into an empty delivery truck. Pump was designed for a minimum capacity of 150 gpm against the total head of the system. The motor is 10-hp, 208-v, 3-phase.

There are six circulating pumps in the boiler room used to circulate the hot water to and through the underground distribution system. The

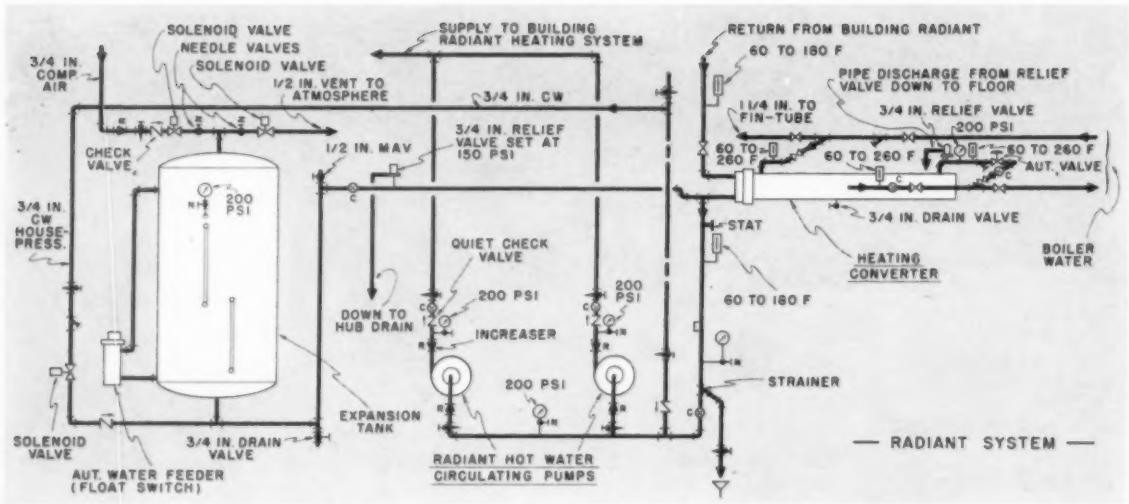


Fig. 6. Piping diagram for heating system in individual building. Hot water from boilers transfers heat to converter, and heated water in radiant system is then circulated within the building. Radiant system has own expansion tank, pumps, make-up

pumps are of the double suction type, with horizontal-split case, bronze fitted with bronze impellers, and bronze wearing rings on impeller and casing, mechanical seals, and steel shafts. Each pump has a capacity of 450 gpm against a head of 115 ft and no-delivery head of 150 ft. Pumps were specified with "no cavitation" at heads down to 20 ft. Maximum delivery at 55 ft is 600 gpm. Motor is a 20-hp, 208-v, 3-phase unit, at 1750 rpm.

Expansion tank for the distribution system is located in the boiler house. It was specified as an ASME approved and stamped unit designed for a working pressure of 100 psig. It is made of black steel with both heads bumped. The size is 6 ft in diameter by 30 ft in length, which means that it has a 6,000-gal capacity. Cold water make-up line to the expansion tank is an automatic water feeder with a 120-v contact switch for a low water alarm.

Radiant systems in each building were designed to carry supply water from the converters at a temperature of 130 F and the return at 100 F.

Hot water converters at the buildings are of the shell and tube type with the radiant-heating water going through the tubes and the boiler water in the shell. The area of the heating surface was based on a fouling factor of 0.001-in. Converter capacity for the 19-story building is 11,040 mbh heating 735 gpm inside the tubes from 100 F to 130 F, with 245 gpm in the shell from 220 F to 130 F. Minimum heating surface was specified as 620 sq ft and maximum pressure drop through tubes at 4 ft, and through the shell at 10 ft. Size of the unit is approximately 21 in. in diameter and 12 ft long.

Converter was designed for a working pressure of 175 psig on the tube side and 125 psig on the shell side. All units were specified as ASME stamped and certified.

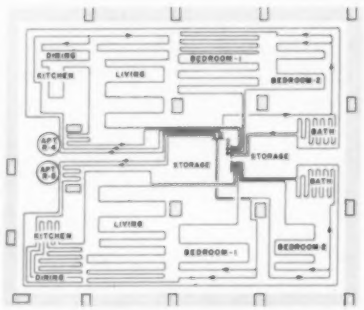


Fig. 7. Typical arrangement of copper coils embedded in concrete floor-ceiling slab of apartments. Tenant can turn off all but peripheral coil

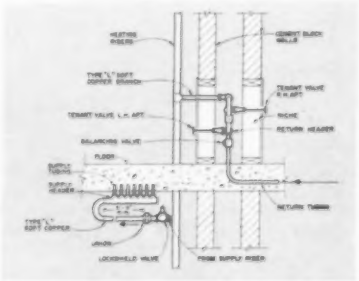


Fig. 8. Detail at radiant header niches for control valves located in apartments

Radiant hot water circulating pumps are non-overloading, single-suction, vertical split casing units with mechanical seals, bronze impellers and casing wearing rings.

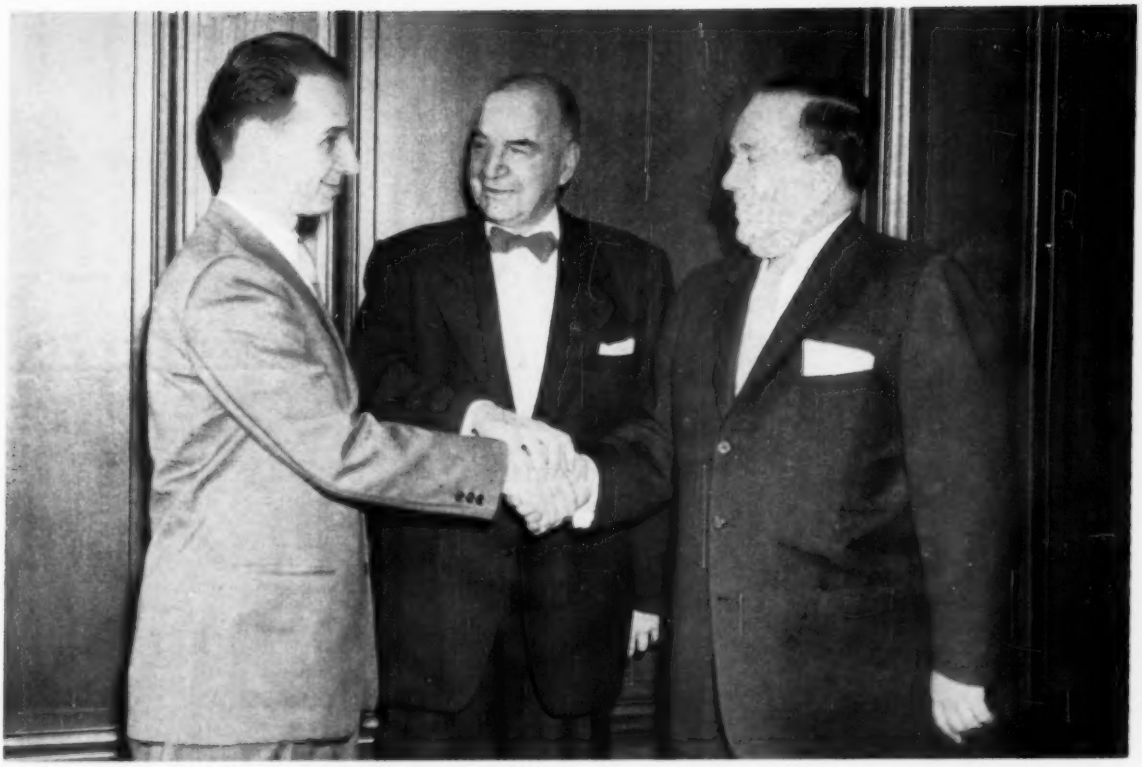
Automatic water feeders control the cold water make-up to the expansion tank in the 19-story building. The controls consist of a solenoid valve and 2-stage magnetic level controller. The high stage controls the solenoid valve.

Tubing in the slabs is all-copper, type "L", soft-temper. The radiant tubing is ½-in. OD in most cases. Joints in the copper tubing are made up with solder couplings or fittings. Fittings used with the copper tubing are the solder-type of wrought copper, and all adapters for pipe threads are either forced or made from drawn rod. The solder for all joints and fittings was made up of 95 per cent tin and 5 per cent antimony.

Tubing was laid on the underside of the first layer of reinforcing rod set on the wooden forms, and was fastened securely to the rods with wire. Tubing was kept level and without sags at all times. After fastening where necessary to support tubing across spaces between reinforcing bars, additional galvanized chairs or galvanized bolsters of the same type were used. Tubing was fastened to these chairs with galvanized wire.

In order to be sure that all tubing was clear, unobstructed and free from all loose dirt, particles of solder, etc., the inside of the tube circuit was blasted with a high pressure gas (nitrogen or CO_2).

After the tube circuit was cleaned, it was given a 2-hour test with nitrogen or CO_2 at a pressure of 250 psi. Several of the circuits were tested simultaneously in order to speed up the tests. After all tests were completed, the tubing was filled again with nitrogen or CO_2 and back to a pressure of 250 psig. This pressure was maintained on the tubing while the reinforcing was being laid and the concrete poured. This pressure stayed on the system until the concrete was set. THE END



Editor Chester Earle of POWER ENGINEERING (center) congratulates John Duba (left), the new assistant mayor of Chicago, and Mayor Daley (right) in City Hall. Appointment of Duba, an engineer, was acclaimed by press, civic groups

Engineer To Help Run Nation's Second Largest City

CHICAGOANS SAT UP and took notice recently when Mayor Daley announced that the newly-created post of deputy mayor had been filled by the appointment of John G. Duba, a graduate engineer and former instructor at Northwestern University, Illinois Institute of Technology, and University of Missouri.

Although Duba's appointment came as a surprise since he has no political background, the assignment was acclaimed by all Chicago newspapers and civic bodies.

Chester R. Earle, Editor of POWER ENGINEERING, discussed the new job with Duba and Mayor Daley in City Hall. What, Earle asked Daley, was the reason for selecting an engineer to fill this No. 2 spot in Chicago's city government?

"The city," said Mayor Daley, "is now carrying on the most far-reaching public works and physical improvements programs in its history. These programs involve nearly every department and activity of local government. It just makes sense to pick an engineer with Duba's wide experience in these fields to help all the city department heads."

"As the No. 2 Administrator for the city," Daley continued, "Mr. Duba will supervise departmental operations, set up reporting procedures, and coördinate activities of city agencies."

Duba is a registered professional engineer in Illinois, and has had practical experience in transportation, city planning, highway engineering, water supply and sewerage, rivers and harbors, engineering economics, and contract negotiation. He has also served as municipal engineering and plan consultant for various municipalities, consulting firms, and industrial organizations.

In congratulating the Mayor on the appointment of Duba, Editor Earle pointed out that many municipalities will be watching the results of this step forward in city government. Engineers have served their communities in the past, remarked Earle, but few have been deliberately selected to fill such an important office in a large city.

There is considerable significance in this development for engineers in general. It begins to appear that the public at large is becoming aware of the importance of the engineer, his way of thinking, and the value of his training. There has been, in the past, too little awareness of the fact that the same qualities of mind and training which the public accepts as valuable in the lawyer or the physician, are attributes of men schooled in the engineering sciences.

Application of logic, ability to reason to a conclusion from a given set of facts, the faculty of organized analysis — all these are the mental stock in trade of the engineer. In the broader sense, the development of these abilities has been the purpose of his education and training — he is *not* trained for the purpose of memorizing formulas and steam table data.

It is rather obvious to us that such men are good, practical choices for office in government as planners and administrators. The time has now come for engineers themselves to realize their own potentialities for public service. THE END

Fig. 1. Increasing popularity of outdoor stations, such as Joppa, shown above during construction, presents problems in lubrication of outdoor equipment. MoS_2 is an ideal solution

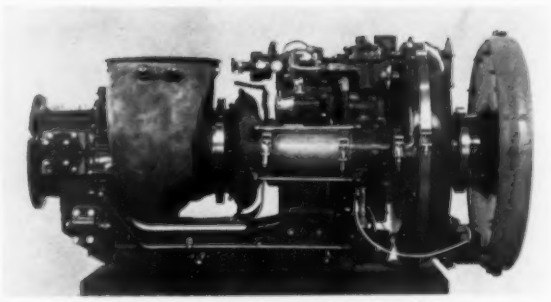


Fig. 2. With the advent of the gas turbine era, high-temperature lubrication gained considerable urgency. Molybdenum disulfide is one of the most promising of the solid lubes

Fig. 3. Anti-seizing qualities in addition to permanence and lubricating ability make moly a natural for treating these huge studs on the shell of this high-pressure turbine

Molybdenum Disulfide Does It!

. . . Versatile Lubricant Cuts Application Costs, Down Time

FROM TRAVELING CRANES in steel mills, operating in high ambient temperatures and intense radiant heats, to the driving chains of industrial stokers, molybdenum disulfide is making itself known and appreciated as a lubricant. Its uses in the fields of power production and utilization seem almost limitless. Capable of withstanding extreme pressures, high temperatures, and giving long life under normal or unusual conditions, it is finding wide acceptance by power engineers throughout the country.

Molybdenum disulfide has high adhesiveness and cohesiveness, and actually forms a coating over the metal it is protecting from wear. This eliminates metal-to-metal contact completely, substituting contact with a coating which has a very low coefficient of friction.

Advantages, then, are cumulative. In many applications where poor or no lubrication and heavy wear have long been accepted as inevitable, moly lubricants are improving efficiency and lowering maintenance and operating costs.

The ability to withstand greater severities of shock, heavy loads, high temperatures and high speeds extends materially the cycle of lubrication in almost any application. This means substantial economies in application costs, reduced down time, reduced power requirements, and reduced wear of equipment.

Like every other lubricant, no single formula is a cure-all for all lubrication problems. Molybdenum disulfide is to be found commercially in a wide range of carriers, each combination or dispersion designed for specific purposes, and, in some cases, limited to those purposes. It is also available in combination with graphite, which gives certain desirable characteristics.

Basic Ingredient

All moly lubricants are based on molybdenum disulfide in powder form, ground to a fineness in the sub-micron range. Some manufacturers attain an average particle size as low as one-half micron, 100 times smaller than the human eye can see. This powder is chemically stabilized to a pH factor of between 7 and 8, as compared with the raw material pH factor of 5. This assures that the product does not promote corrosion.

Molybdenum disulfide powder will withstand temperatures up to 750 F in air, and 2350 F in non-oxidizing atmospheres. It has an extremely low coefficient of friction, ranging from 0.03 to 0.06. Its specific gravity, however, is 4.8 to 5.0, creating difficulty in maintaining suspension in some dispersions.

Versatility Outstanding

Following is a run-down of the moly disulfide lubricants commercially available from one of the leading producers, and is believed to be typical of the field. It is presented to: 1, illustrate the versatility of the product in covering the entire scope of lubrication; 2, to point out the various MoS_2 lubricants available,

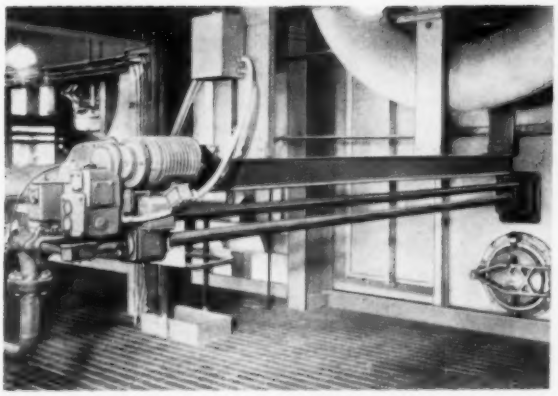


Fig. 4. Retractable soot blowers, always a lubrication problem, have proved to be a successful application for MoS_2

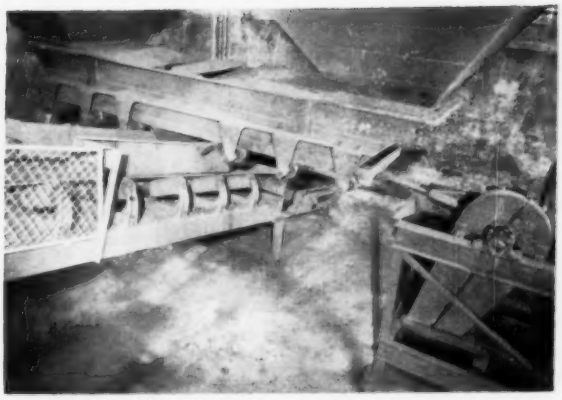


Fig. 5. Extremely resistant to dust, dirt and weather, moly lubricants are ideal for these moist conditions, or outside

and how they may or may not be applicable to given uses; and, 3, to note that, as with any other group of lubricants, considerable responsibility is incumbent upon the engineer in the selection of the proper material.

Lubricant A. Heavy concentration of MoS_2 powder in lithium-base carrier. Grease consistency. Actually contains two compatible lubricating films. Will endure extreme pressures at high or low speeds. Stable under changing conditions, lubricates over wide range of temperatures (–30 F to 300 F). Highly adhesive and cohesive. Impervious to water, resistant to most acids and alkalis. Resists oxidation, and is rust preventive. May be diluted with general petroleum oils or cutting oils.

Uses: heavy-duty lubricant, anti-seizing compound, break-in lubricant for dies, additive to machine and cutting oils for imparting extreme pressure characteristic, general purpose lubricant in plant.

Typical applications: high-pressure turbine pedestals, retractable soot blowers, plain and thrust bearings, sliding surfaces, welder guides, gears, tapers, cams, lift channels and machine ways, dead centers, collets and chucks, schives, press fittings, studs on diesel engines.

Not to be applied to: precision anti-friction ball or roller bearings.

Lubricant B. Same as Lubricant A, but with light concentration of MoS_2 powder. Similar characteristics but withstands extreme pressures to a lesser degree.

Typical applications: ball and roller bearings, plain bearings, wheel bearings, cam follower bearings, heavy-duty mill bearings, schive bearings, live centers of lathes, track rollers of bulldozers; lubrication of sealed units requiring a grease of excellent storage quality; break-in lubricant for machines; starter gears, extreme pressure lubrication of open gear, motor couplings, cable coating.

Lubricant C. Blend of synthetic diester-base grease with light concentration of MoS_2. Operates between –100 F and 300 F with little change in consistency. Very effective lubricant at low temperatures, and low volatility at high. Permanent type, resists oxidation and is non-corrosive.

Typical applications: pneumatic and hydraulic systems, control boxes, ball and roller bearing units, instruments, gear trains and reducers, conveyors, electric motors and pumps, car shakers.

Lubricant D. Heavy concentration of moly disulfide powder in silicone compound. Grease consistency. Long-lasting, extreme-pressure, waterproof lubricant with good preservative qualities. Retains consistency during long exposure to temperatures from –65 to 400 F, will not melt, crack or harden. Good dielectric properties, good release qualities, corrosion and oxidation inhibitive. This grease is dissolved by concentrated acids and caustics.

Typical Applications: gaskets, rings and seals, leather diaphragms; between metal and plastic, or glass and plastic; electrical cables for pulling through conduit; damping medium and combined preservative and lubricant on metal, rubber, plastics and ceramics.

Lubricants E and F. Blends of a silicone oil with MoS_2 powder, one an oil, the other a paste. Oil not recommended where severe filtering is employed because of pickup of moly powder. Operating range from 5 F to 550 F, with intermittent tolerance of 700 F. Extremely long life span under these conditions, relative to petroleum products (10 times). High affinity for metallic surfaces, may be used effectively on plastics or synthetic rubber.

Typical applications: oven conveyors, chain and sprocket drives, furnace and over doors, conveyors over plating tanks (corrosive vapors), high temperature pump packings and seals.

Lubricants G, H and I. These are blends of MoS_2 powder and synthetic polyalkylene glycol. They are adapted to and highly effective for special lubrication problems.

Four other products of this producer are blends of moly and petroleum, another is a blend with penetrating oil. A sixth additional blend is with mineral oil, with which, fortified with anti-foaming agents, outstanding results have been obtained in the operation of the transmissions and differentials of light and heavy trucks, bulldozers and heavy tractors.

In addition to the 15 lubricating compounds mentioned above, 11 others are offered, two of which are

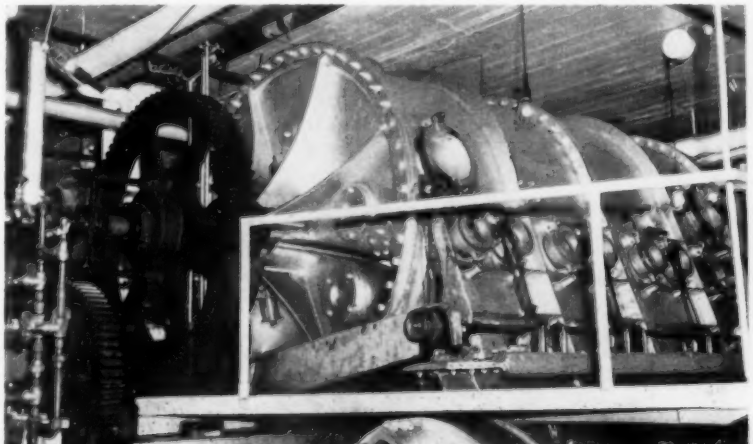


Fig. 6. Where labor enters the picture, such as on this drum dryer, with gears and chains, solid film lubricants can pay for themselves many times over others

powders, commercially pure molybdenum disulfide. One of these powders is the sub-micron fineness, which is used in all of the above products, the other is a coarser grade (90 per cent less than 74 microns, 60 per cent less than 44) for special applications. Only the former is offered in combination with nine carriers to form the total.

Carriers include water, lacquer, naphtha, resins and mineral spirits. They form the basis for the application of molybdenum disulfide coatings either during use or previous to use, frequently even before release from the factory.

Pre-applied coatings in solid dry film form are attracting attention, for they make possible effective lubrication at virtually no maintenance cost for indefinitely long periods, and over wide ranges of temperature. Additional feature is that they will not attract dust or dirt, and, having an exceptionally high film strength, are extremely resistant to it. This combines with their weatherability to make them ideal for numerous outside applications, such as coal handling mechanisms, where the ambient frequently varies annually up to 130 F in temperate climes.

Preparation of Surfaces

If coatings are to be applied as tenaciously adherent lubricating films, intended to serve for long periods under severe conditions without frequent replenishment, it is necessary to prepare the metal surfaces for bonding the lubricant either by mechanical or chemical methods.

Mechanical methods produce a slightly porous condition on the metal surfaces, and are perhaps the most desirable for inducing adherence. These methods include roughing, grinding, but chiefly blasting with sand, alundum, emery, steel particles, corn cobs or rice hulls.

Chemical surface treatments are quite varied and are exemplified by caustic etch, acid pickling, anodizing, phosphatizing, chromatizing and oxide coatings.

It is interesting to note that some variations from common practice are desirable when using solid film lubricants. For instance, the rule of not using similar metals in plain and rubbing bearings may be overlooked in favor of using the hardest metals practicable, since the film actually prevents metal-to-metal contact. The harder metals will give lower friction, and longer wear, thus compounding the advantages of these lubricants.

Where metals of different hardness give a choice as to which should be coated, the softer metal generally should be treated. Friction will be slightly higher if both metals are coated, but offsetting this is the fact that wear life is increased, so that each case must be considered individually. Usually, too, it is better to coat the moving part rather than the stationary, unless the moving part is considerably smaller.

Oxidation Products

Experimental results have indicated that the oxidation of MoS_2 in air starts slowly at approximately 750 F, and proceeds rapidly at 1000 F. This is doubly damaging, in that the products of oxidation are the highly abrasive molybdenum trioxide, MoO_3, and sulfur compounds which are apt to react unfavorably with the metallic components of the bearing.

Limitation of the bad effects of oxidation at high temperatures can be achieved by two methods, the restriction of available oxygen, and the use of materials unaffected by the resultant sulfur compounds. Both have been used in high temperature applications. Obviously, the latter method does not prevent oxidation, and in these cases it has been found that the formation of MoO_3 eventually results in substantial increases in the amount of friction.

If further information on molybdenum disulfide lubricants is desired, write The Editor, or jot down Moly at the bottom of the inquiry card elsewhere in this issue. THE END

Hyperbolic vs Mechanical-Draft Cooling Towers

NEARLY every time the subject of cooling towers is discussed by power engineers, somebody is sure to ask, "Why don't we in the United States use the big hyperbolic, chimney type cooling towers so widely used in Europe, and especially in Great Britain?"

To answer this question, some interesting facts were included in a recent ASME paper, No. 57-PWR-5 by E. E. Goitein, Chief Engineer, Cooling Tower Department, Foster Wheeler Corporation.

The author first reviewed the general cooling tower situation in the United States. Generating capacity, he reminds the reader, installed by the power industry has doubled in the past ten years. The once-abundant supply of once-through circulating water for steam turbine condensers and other equipment has all but disappeared. Thus the cooling tower has become an integral unit of steam-electric station equipment.

After discussing economic applications of cooling towers, the author turned to the selection of cooling towers to fit given requirements. In doing this he referred to the hyperbolic cooling tower and offered the following comments.

The hyperbolic tower is a unique form of natural-draft design, making use of the stack effect of a hyperbolic chimney-type structure (figure). The air inlet, water-distribution system, and fill are essentially the same as in a mechanical-draft tower. The packed height and hence the pumping head are usually somewhat higher. These towers have been built as high as 310 ft, with a base diameter of 210 ft and a throat of 120 ft, widening to a diameter of 134 ft at the top.

Despite the fact that the first cost of hyperbolic towers is one and a half to two times that of mechanical-draft towers, depending on the severity of cooling requirements, the British Electricity Authority has installed a large number of such towers in central stations throughout England. It is interesting to examine some of the factors which make this design attractive there and yet impractical in this country. Some of the considerations are:

1. Wet-bulb temperatures are generally lower and consequently the approach to the cold-water temperature is increased. This wider approach causes a greater difference between the ambient and the exit wet-bulb temperatures, and consequently a greater difference in density. This improves the air flow through the hyperbolic tower, which is entirely dependent on the stack effect.

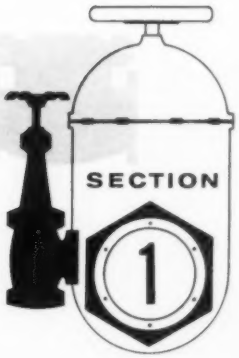
2. The wide approach, or in other words the "easier" cooling duty for a given heat load, keeps the size of these units within practical bounds.

3. Loads are lower in summer than winter so loss of capability is not as important.

4. These plants are government owned and operated, and no taxes are involved. The capitalization rate is only 7.5 per cent, which favors equipment of high initial cost.

5. With fuel costs many times higher than in this country, the savings achieved through the elimination of any fan-power requirements are tremendous.

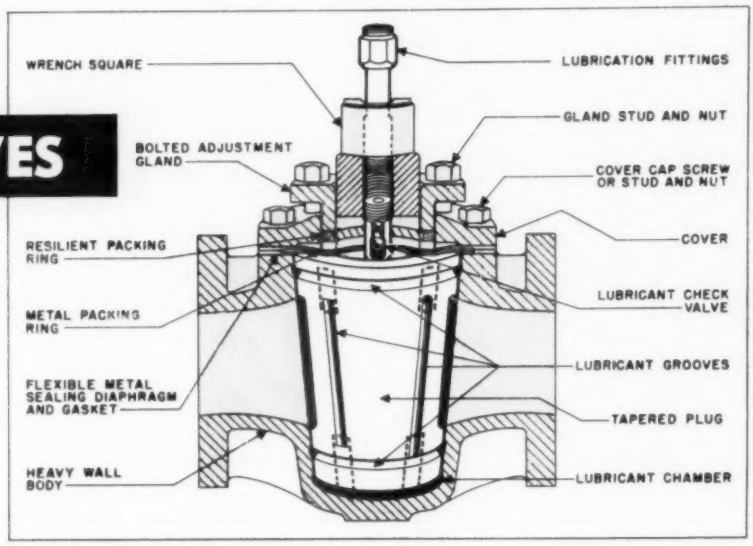
These natural-draft cooling towers are common features in European landscapes



Power Engineers' Valve Manual . . .

Here's a practical guide to the basic valves used in the power field. Each section is written by an authority, and explains the function and applications of one valve type. Other valve sections will appear in future issues

PLUG VALVES



By PAUL A. MANOR

Chief Engineer

Central Valve Research

Rockwell Mfg Co

A native of Toledo, Ohio, Paul A. Manor attended Ohio State University and the University of Toledo. After college, he joined the Surface Combustion Corporation, in Toledo, and advanced to the position of Chief Project Engineer after 17 years of service with the company.

Mr. Manor joined the Rockwell Manufacturing Company in November, 1954. He became Chief Engineer of the company's Barberton, Ohio Valve Division, and held this position until the summer of 1957. At that time he was promoted to the position of Chief Engineer, Central Valve Research and Development Department, at Pittsburgh, which position he holds at this time. His wide experience in the field of valve design and research qualifies Paul A. Manor as an expert in this field

BECAUSE OF ITS compactness and simplicity, the lubricated plug valve is gaining fast acceptance by power plant engineers. It is easy to operate, offers positive closure, and lends itself to automatic control — a popular trend in power plant operation.

Already well established in petroleum, chemical process and related fields, the lubricated plug valve now is proving its worth in power plants, within a wide range of temperatures and pressures. It can safely and efficiently handle gas and liquid fuel, boiler feedwater, condensate, and similar elements.

Several basic features make the lubricated plug valve ideal for power plant application. Unlike many common types of valves, it has no high projecting yokes or bonnets, no exposed threads, no underhanging body to waste vital space. In complex piping systems, valves may be easily operated by centralized control. And there's no danger of leaks, even in gas piping systems, because of the valve's unique method of sealing.

Valve Design

The lubricated plug valve is of the "block" or complete shut-off type. It may be used for throttling where accurate adjustment is not necessary. But the primary service is positive open-close operation.

Three basic parts comprise the lubricated plug valve: body, cover and plug. The plug is the only movable member. The valve is opened by rotation only, the plug turning on a lubricated seat. While the plug is available in cylindrical and tapered form, the latter is generally preferred, because the tapered rotary principle results in quick and simple valve operation. The conical shape of the plug combines the tight fit advantage of wedge action with the sliding action of rotary movement. Rotation eliminates the need for raising and lowering a movable valve member, and protects seating surfaces from exposure to corrosive elements.

A lubricated gland-joint shoulder is used, rather than conventional stuffing boxes which operate by gripping around a stem or rod. The shoulder joint is compact, produces a minimum of friction, and combines the functions of stem seal and thrust bearing. Application of the shoulder seal principle involves either the two-bolt cover (which combines cover and gland in one piece), screwed gland, or bolted gland. Thrust against the upper shoulder of the tapered plug is transmitted through a resilient cushion packing and a sealing diaphragm gasket. The sealing member is a thin flexible metal diaphragm.

The diaphragm assembly is clamped firmly together and does not rotate. As the valve is turned between open and closed positions, the ground sur-

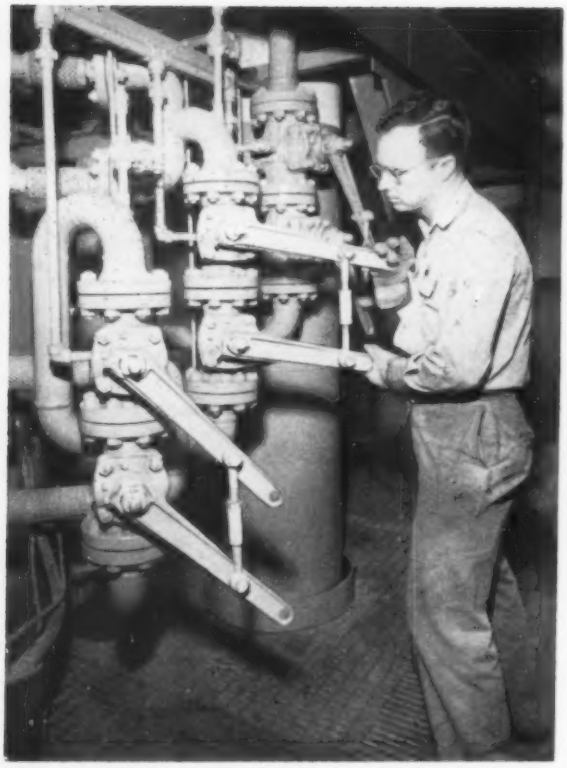


Fig. 1. By linking hand levers together, it is possible to open fuel gas valves while closing the vent. In each case, the vent line is connected to the upper valve

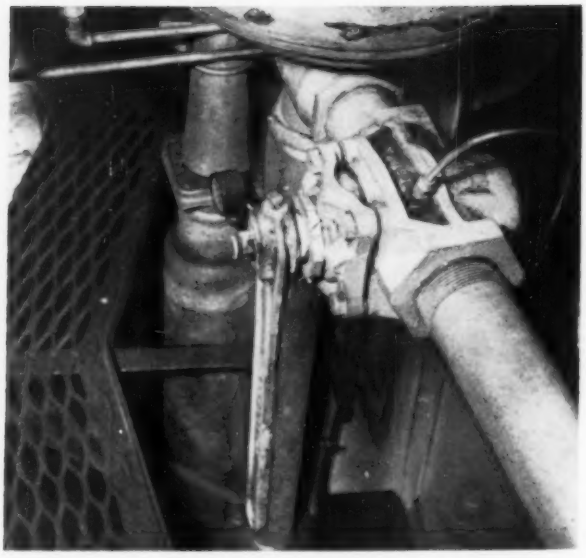


Fig. 2. Approved gas cock on furnace control system insures against premature admission of gas to open burner cocks. Note integral handle, and tubing connected to checking port

face at the top of the plug slides freely against the metal diaphragm. Leakage is prevented by the lubricated close fit between the two parts and the narrow area of contact through which the plug-sealing thrust is applied.

Pressure Lubrication

Pressure lubrication performs three important functions in this valve: 1, provides "jacking" action; 2, seals the valve; 3, minimizes friction.

Lubricant pressure exerts powerful jacking action against the smaller end of the valve plug, momentarily unseating it. This action overcomes any adhesion and, because of the taper, creates a small space for the confined lubricant film between the plug and body. As a result, no matter how long the valve remains closed, the plug may be unseated without using a hammer or wrench. Further, the jacking not only puts a valve into operation after long disuse, but provides lubrication at the same time.

The usual means of obtaining lubricant pressure is an elongated screw, threaded into the outer end of the plug shank. Because of its small diameter and the use of a fine-pitched thread, the lubricant screw develops ample pressure on the lubricant, yet turns freely. These screws are often provided drilled and fitted with a little giant "button-head" fitting for grease-gun lubrication.

Lubricant is distributed between the plug and valve body by means of lubricant grooves, divided between the body and plug. The grooves are so located that when the valve is in the closed position, valve ports are completely sealed by a lubricant film between the ground seating surfaces. Placement of grooves is such that groove sections exposed during operation are disconnected from the lubricant supply before they are brought in contact with the line-fluid. The grooves are automatically reconnected when the plug is brought to the fully open or closed position. Thus the valve can be partly opened without blowing out the lubricant.

One of the outstanding features of the plug valve is its quick opening-and-closing operation. A quarter turn fully opens or closes the valve. With the help of a stop collar on the valve, the operator does not have to rely on the feel of a wheel's resistance to tell if the valve is closed. Valves are wrench, or gear, operated.

Most all plug valves have a flat or a square wrench head on the plug stem and a stop-and-indicating collar which also serves as a weather shield for the stem clearance space.

Because of the tapered plug and lubricant sealed design of these valves, they are not restricted to one-way flow, i.e., the valve can be installed in either direction because it holds pressure in either direction. Flow can be reversed any time without the danger of leakage or jamming.

This feature means a constantly renewable valve seat. Instead of expensive repairs on seat and closing members, simple lubrication renews the sealing surfaces without necessity of dismantling the valve or even removing it from the line.

A common hazard to the life of valve seats is the abrasion caused by dust, dirt, and debris in the line. This hazard is entirely eliminated in the lubricated plug valve if proper gland adjustment is maintained. Critical seat areas are fully lubricant sealed, and the lubricant is under pressure so that abrasive material cannot intrude. Any dirt or material that may reach the plug is scraped off when plug is turned back to open position.

Regardless of line pressure, the plug valve can be relubricated as effectively as with no pressure. Lubricant pressure builds hydraulic pressure within the valve to the required degree. In this way the plug can always be effectively lubricated and the jacking chamber under the plug adequately pressurized to permit easy turning. As a result, even if a lubricated plug valve is unopened for extended periods, it can be easily opened without the difficulties of galling or freezing.

Lubricated plug valves are available in a variety of patterns, metals, and sizes, depending on their application. To handle the wide range of

Fig. 3. Gas main valves operated by hand wheel and worm gear. Valves are at the motorized main shut-off valve on main from gas plant. All are lubricated plug valves as described

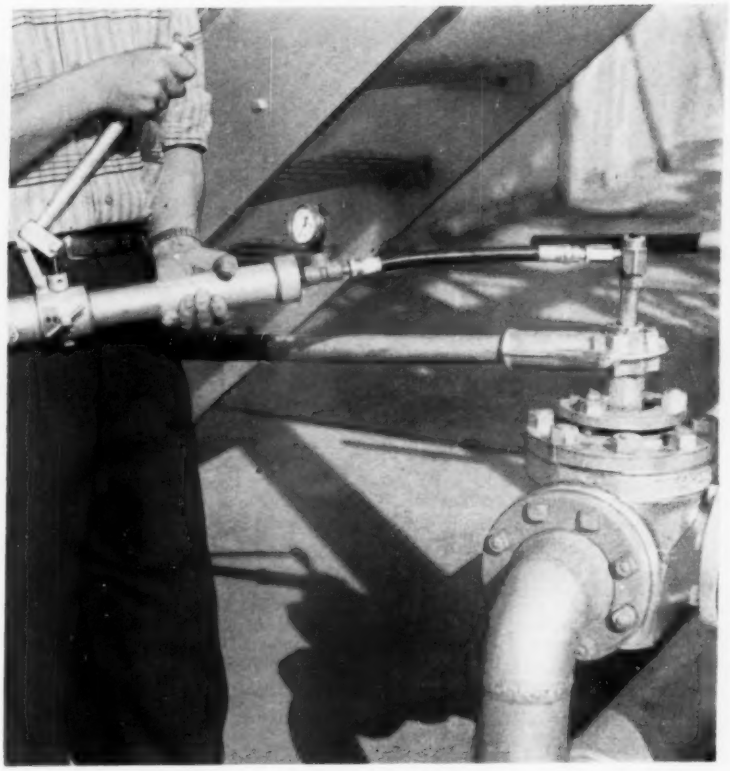


Fig. 4. High-pressure hydraulic handgun, specially designed for plug valve lubrication, is self-priming and has gage attached to indicate jack pressure

temperatures, pressures, and services, valves are made from a number of metals and alloys including bronze, carbon steel, alloy steel, semi-steel, and stainless steel — hard faced or chrome plated. They are obtainable in sizes to 30 in., and to 15,000 psi.

Valves can be equipped with every type of standard or special flanges, including Dresser ends. For jacketed service, valves are available with complete flange-to-flange jacketing in standard sizes. Plug valves are also made in patterns interchangeable with standard gate valves.

Another unique characteristic of plug valves is the ease with which they can be adapted for multi-port construction. In the three-way form, a single L-shaped passage connects any of two ports; with a T-shaped opening any of three ports are connected; and the four-way type has two cut-outs on opposite sides which connect any two adjacent parts of four ports with a quarter turn.

An important adaptation in a number of plants is use of the valve in mechanical blinding. Two straight-way lubricated plug valves may be butted together in series and operated in unison through a common linkage. A bleeder valve located between them is operated through the same linkage in such a way that when the two block valves are closed the bleeder is automatically opened. This arrangement avoids drainage losses and prevents pressure build-up and the resulting hazards (see Fig. 1).

At gas-fired power plants, a special plug valve is available for positive prevention of fuel explosions. Approved by Factory Mutual Laboratories, the method assures closure of all individual burner cocks before the main burner gas safety shutoff valve can be opened. The valve is similar to a conventional lubricating unit, except that it incorporates two side outlets connected in series with copper tubing to adjacent valves so that when the gas passages of all valves are closed a new continuous passageway is provided through all closed valves in the system (see Fig. 2).

Valve Accessories

A wide variety of devices is available for special operation of the lubricated plug valve. Locking accessories, for instance, are obtainable for sealing a valve in either open or closed position, preventing removal of the valve or tampering with its parts. For hard-to-get-at places, chain wheels, double end chain wrenches, and a variety of extensions are available.

Simple quarter-turn operation makes the lubricated plug valve ideal for an automated power plant. Remote power operation extends the sphere of valve control because line flow can be manipulated from a centralized panel board. It can save many man-hours in normal operations, and preserve a large investment in case of emergency.

Valves may be operated pneumatically, hydraulically or electrically, in connection with automatic time clock, level, temperature, flow, or differential control systems. In all such systems, valve controls may be interconnected to give "chain reaction" control for sequence operations of all types. Power is applied by various types of operators, which can be either semi-automatic or fully automatic. And sometimes the valve may be powered by fluid energy drawn directly from the line (see Fig. 3).

Because of the wide range of conditions for which plug valves are designed, a number of lubricants are available. And the use of the proper lubricant is important because the valve structure and plastic sealing film are an integral unit, each component dependent on the other for best performance. Obtainable in sticks, tubes, and bulk form, lubricant can be added to the valve by hand, hand gun, or bucket pump. It takes a minimum of time, yet a simple program of periodic lubrication will keep valves in service for the life of the piping (see Fig. 4).

To simplify lubricant selection, valve manufacturers continue to reduce the number of choices by developing basic, multi-purpose lubricants. An idea of their progress may be gained by considering the properties

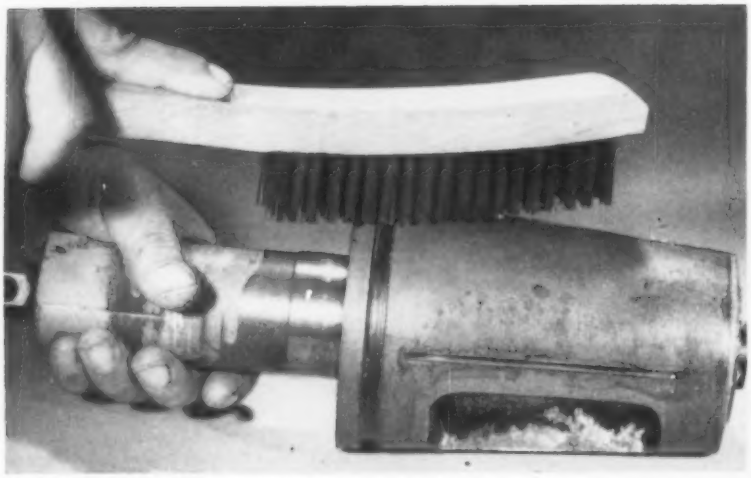


Fig. 5. Heavy accumulations of dirt, paint and foreign matter should be cleaned before disassembly. Then all parts should be wire brushed and cleaned with some solvent solution to remove internal grease and accumulated pipe sediment

Fig. 6a, right, above. Plug valves can be reclaimed for further use by relapping to eliminate scaly deposits and superficial scoring and pitting. Shown is lapping compound on surface of plug, ready to be inserted in valve body for next step

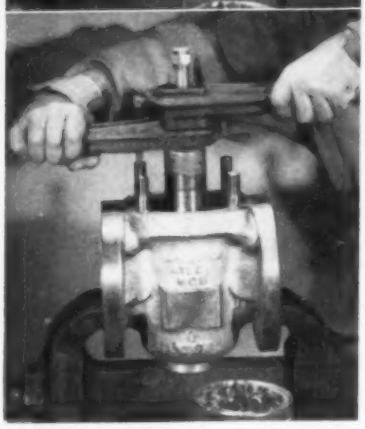


Fig. 6b, right. Shown here is hand-lapping of plug valve to insure close body-and-plug fit. This is the final operation before reassembly of valve parts, to prolong valve life indefinitely. Decision to do this work is based on inspection

of the recently developed 555, which replaced four other lubricants in the Rockwell-Nordstrom line. The new lubricant has an efficient temperature range of 40 F below zero to 500 above and is recommended for use with a variety of piping elements.

Maintenance Tips

To help operators get maximum life from lubricated plug valves, the following tips are offered:

1. Plug adjustments should be snug — tight enough to keep the plug from becoming unseated, but not to a degree requiring excessive force to operate the valve.

2. Lubrication should be periodic, systematic, and with the proper grade of lubricant.

3. If the valve system is filled, fresh supply of lubricant can easily be forced between the seating surfaces by giving the lubricant screw a few turns. Depletion of lubricant in the system will require the addition of several sticks before lubricant can be forced into the seat. In this instance, lubricant should be added until resistance is felt in turning the screw.

4. Turn the plug slightly when lubricating to assist in the distribution of lubricant and to determine if the adjustment is correct. If the valve is lubricated with the adjustment too loose, it can be corrected by alternately tightening the adjustment and turning the plug. This will work out excess lubricant and permit the plug to return to its proper position in the seat.

5. At the time of adding new lubricant, care should be taken to prevent any solid foreign material from entering into the lubricant space of the valve.

Lubricated plug valves are usually worth reclaiming if their condition is such as to require only cleaning, inspection and reassembly with new packing and gaskets. Sometimes, a light re-lapping operation may be required to eliminate scaly deposits and superficial scoring or pitting. Judgment must be exercised in cases where the valve body needs reboring and fitting with an oversize plug, or building up of surfaces by welding.

This type of work is not economically justified for low- and medium-pressure valves. As a general rule, complete rebuilding of 4-in., and smaller 175 lb WOG; or 2-in., and smaller 200, 400, 500, and 800 lb WOG semi-steel valves should not be undertaken. A decision should be based on the actual cost in equipment, labor and overhead.

Valves with a heavy accumulation of dirt, paint and other foreign matter should be cleaned before disassembly. After complete disassembly of the valve, parts should be cleaned by using any suitable alkaline or solvent solution. Corroded areas may require wire brushing or abrasive blasting.

Repair procedures are determined by the extent and depth of blemishes in seating surfaces of both plug and body. Tapered seats of both body and plug should be carefully examined for corrosion, pitting, scoring, galling or erosion. For plugs with integral shanks, the machined shank diameter and the adjacent shoulder on the plug should be similarly examined (see Figures 5, 6a and 6b).

Future Developments

Manufacturers continue to work toward increasing the scope of the lubricated plug valve. Not only are new alloys under test, but improved coatings may soon be available to help extend the life of the plug valve.

Probably the greatest challenge to today's manufacturer is the field of nuclear power plants. Radiation introduces unique factors in the design of piping systems, especially in the primary loops. Here, new types of corrosion resistant cladding will have to be developed before the plug valve can be applied. But outside the primary loops, piping in a nuclear power plant probably will not differ much from that in conventional plants. And the plug valve's inherent characteristics of safety, simplicity, and positive closure should make it an ideal component. THE END

Innovations Feature Refuse Incinerator

By introducing hydraulic ash disposal with recycling water, waste heat boilers with turbine-generators, radiant heating, a new dust control system, and other features, this plant departs convention

WHEN OYSTER BAY, L. I., outgrew its existing refuse incineration plant, it was recommended that a new 500-ton-per-day plant be constructed to augment the existing 300-ton capacity. This was done, but with a number of innovations departing quite widely from the conventional, stereotyped design.

Extensive tests and subsequent operation have proven that these departures, questioned categorically in some quarters, were well taken.

Design Problems

In refuse-burning furnaces the nature of the fired substances varies over an extremely wide range as to bulk, moisture content, and heat value. The refuse delivered may range in moisture content from as little as 10 to as high as 50 or 60 per cent. Unburnables, such as tin cans, crockery, bottles and the like, also vary from moment to moment.

As a result, the heat value of the refuse may range from a low of perhaps 2000 to as high as 10,000 Btu, depending on whether the charge contains a large percentage of unburnable matter and high moisture content, or whether it is made up predominantly of paper and wood. In view of this and the fact that excess air may run from 100 to as high as 400 per cent on occasion, and with varying rates of combustion, CO_2 indication as a control has little practical value.

Refuse-burning furnaces must be flexible to meet all firing conditions and proportioned to respond quickly to momentary changes. They must be amply proportioned to meet the most severe condition, yet not overdesigned to defeat their purpose. If the risk of stack nuisances is to be avoided in burning these unpredictable wastes, experience dictates that the combustion temperature must never fall below 1400 F. The optimum temperature range proven in the plant lies between 1800 and 2000 F, with provision for at least 200 per cent excess air.

Plant contains four furnaces, each of 125 ton-per-day capacity, with areas and volumes computed to serve the particular purpose. Each furnace is equipped with a two-section semiautomatic hydraulically-operated stoker having a combined area of 172 sq ft to achieve a burning rate of 60 lb of refuse per sq ft per hr.

Each furnace has two pneumatically-operated charging gates at the top, each 4 ft square, through which refuse is fed by overhead cranes. Each furnace has twin ash hoppers and ash-discharge chutes fitted with balanced gates directly underneath the stokers which discharge into an ash sluiceway.

Innovations

One deviation from past practice is the ash-removal system. It is an enclosed hydraulic sluiceway into which ashes may fall directly from the furnaces where they are almost instantly quenched and carried away by water to a large underground ash tank. Ashes are stored under water in this tank until such time as they are dredged out and loaded in a truck by means of a clamshell bucket operated from a portable crane.

The sluiceway is of ample cross section to receive any object likely to be discharged through the ash-dump openings near the front of the stokers. The bottom of the sluiceway is sloped and lined with vitrified paving brick. Water passes through it at the rate of 4200 gpm at two different pressures, one of which is termed "gravity water" supplied at a pressure just sufficient to have it enter the sluiceway. The balance, termed "high-pressure water", enters through nozzles strategically placed along its length.

The bottom slopes at an angle to achieve an optimum gravity water velocity and a sufficient depth of flow to provide buoyancy and to cushion the impact of falling objects. The high-pressure streams are primarily employed for impact and to break masses of falling residue.

Bearing in mind that the nature of the ash may range from large clinkers weighing from 50 to 100 lb, entwined with large cans and entangling wire, it is not difficult to realize that ash removal can be troublesome, particularly where moving parts such as conveyors are employed. In this sluiceway there are no moving parts whatever, only the water itself, and experience has shown it to be capable of meeting all situations with negligible manpower or difficulty.

Since a considerable quantity of water is necessary for the proper operation of this sluiceway, a system for water recirculation was included in the plant layout. After leaving the ash tank, the water flows to a 50-ft-diam clarifier which provides a sedimentation period of approximately one hr to remove any fine ash leaving the ash-receiving tank. The water then flows to storage reservoirs and is finally returned by two axial-flow pumps to the plant for another cycle. Hence, ash water may be reused for a month or more, depending on its pH and accumulative organic content.

Another feature of this plant, as described in detail by Raisch, consulting engineer in ASME Paper No. 57-A-220, is that it is almost entirely self-sufficient. The burning of refuse naturally produces a considerable quantity of waste flue gases at temperatures approaching those in the furnaces. Theoretically, it is possible to produce an average of about $2\frac{1}{2}$ lb of steam from each lb of refuse burned. In that case, this plant, with its 500-ton rating, could conceivably furnish $2\frac{1}{2}$ million pounds of steam per day.

In view of this, an economic study was made to determine the advisability of utilizing a portion of this heat for producing electric power to run the plant and other buildings likely to be erected on the site. This study showed that the installation of boilers, piping, turbine, and auxiliaries to produce electric power was more than justified from several points of view.

Boilers and power-generating equipment were therefore included. The two waste-heat boilers are each capable of evaporating and producing 13,000 lb of 250-psi steam per hr with ample reserve for 25 per cent overload.

Electric-Power Generation

Steam so produced is utilized in a DeLaval turbine-generator unit of 400-kw rating, which is more than ample to meet all power requirements of the plant as well as requirements of other buildings to be located on the site.

Steam turbine is designed to operate at 5-psi back pressure, thereby permitting the use of exhaust steam in the heating system and for fly-ash-removal purposes, the latter being another innovation in this plant. As a standby to the turbine, an Alco diesel-engine generating unit of 400-kw rating also was installed. This is also used for start-up.

Pump and Well System

Some of the power produced is utilized in driving a 60-hp deep-well pump of 500-gpm capacity, which produces water from a well 490 ft deep. This water is used for all

plant and sanitary purposes as well as fire hydrants on the site. The capacity of the well is more than ample to meet make-up requirements for the ash sluiceway system and all other plant uses.

Consequently, it can be said that with the exception of a small quantity of fuel oil used in the diesel engine during the first few hours of operation following the weekend shutdown, all needs are met by the utilization of waste heat.

Fly Ash Removal

Every effort was made in the design of this plant to minimize fly ash discharge from the stacks. To accomplish this, two large troughed water-bottom expansion chambers were constructed, each serving two furnaces. These are located between the common flue connecting the combustion chambers and the 8-ft, 6-in-diam by 143-ft-high chimneys. Each chamber has a deflecting damper and a water-spray arrangement. In addition, low-pressure steam is introduced at the head end of each chamber.

Water bottoms in these chambers have proven their value in that fly ash once deposited cannot again be thrown in suspension by sudden gusts caused by changing draft conditions. High-pressure nozzles are incorporated at the far ends of these chambers so that deposited fly ash can be sluiced out periodically without interrupting plant operation.

Main control board was installed immediately adjacent to the chief engineer's office. Various instruments, both recording and indicating, are included to show all of the conditions which may influence the operation.

Another feature is the method of controlling the dust which arises from the refuse-receiving bin as loads are discharged from trucks. As trucks dump their contents the fall may be as much as 27 ft. For this reason, inlet ports were provided near the top of the bin through which air may be drawn across the top of the bin, thereby creating an air current cutoff to prevent much of the dust from rising to higher elevations.

Two 9600-cfm Sturtevant fans, operating at a 3-in. static pressure, are used for this purpose. Discharge from these fans is through an air filter before it is released to the atmosphere.

Since dangerous gases are likely to accumulate at the bottom of the bin, air is also constantly withdrawn through a continuous trough along the bottom by two 3800-cfm Sturtevant fans, the discharge of which also passes through an air filter. In addition to these fans, 43 other fan units are utilized throughout the plant for various purposes.

Other Features

An interesting, though relatively minor, feature is radiant heating in a portion of the charging floor. Since the large overhead doors, located at the charging-floor level must necessarily be kept open, charging-floor attendants can be made somewhat more comfortable during the winter months with this type of heating.

Other things not ordinarily found in incinerator plants also have been included, such as a complete machine shop where repairs can be made quickly. Electric welding is made more convenient by electric welding outlets throughout the building. A combination freight and passenger elevator was installed, which travels from the ash floor to the crane-cab level.

Two 3-$\frac{1}{2}$-ton, 50-ft-span, traveling cranes with 2-cu-yd clamshell buckets were provided for elevating the refuse from the receiving bin to the furnace-charging hoppers. Ample parking space has been provided for both cranes, thereby enabling either crane to service all four furnaces. Chilled water is piped throughout the building for the convenience of the personnel.

Operation

Plant is operated 24 hr a day, 6 days a week, under the direction of a licensed engineer on each shift. The staff contains an experienced machinist, master mechanic, boiler-watch attendants, engine-room attendants, and the usual complement of crane operators, furnace, ash and charging-floor attendants.

Although designed to incinerate 500 tons of mixed refuse per 24-hr day, tests have shown it to be capable of exceeding this figure by 5 to 10 per cent, depending on the nature and moisture content of the materials burned.

Construction Cost

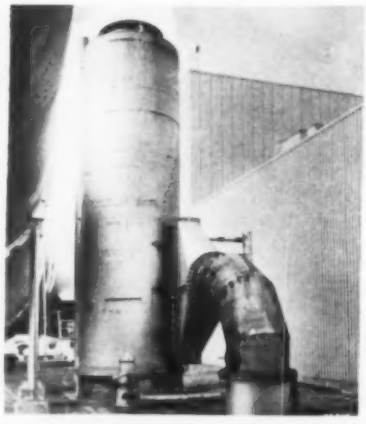
Construction cost of the plant, including all appurtenances, such as the deep-well-pump installation, the clarifier for treating ash water, the reservoirs for storing ash water, access roads, etc., was $1,699,152.44, to which must be added the usual legal and financing costs. THE END

Unique Use of Water Separator Snubber Saves on Equipment Cost

THE LIMIT of a product's service horizon is never really known — new applications develop when least expected. This is brought out in the case of the Burgess-Manning water separator snubber, originally designed to provide the dual function of exhaust gas silencing and removing of all of the seal water from the exhaust gas of vacuum sealed pumps.

A problem arose at the National Advisory Committee for Aeronautics Lewis Flight Propulsion Laboratory at Cleveland, Ohio, in connection with the silencing of the discharge from two eight-cylinder compressors of 40-in. bore and 14-in. stroke, used to exhaust air from a closed chamber to the atmosphere. Oil from the discharge of other vacuum pumps had proved to be quite a nuisance.

Initial plans to overcome this situation called for an exhauster head on top of the silencer, into which water would be sprayed, in an attempt to remove the oil from the air stream.



Burgess-Manning water separator snubber, 9 ft in dia and 35 ft high, eliminates need for exhauster head in silencing two 8-cylinder compressors, separates water and oil from the exhaust stream

After an engineering study, NACA purchased a Burgess-Manning water separator snubber, eliminating the need and cost of the exhauster head. The B-M water separator snubber that was installed measures 9 ft in diameter and 35 ft in height. It handles up to 100,000 cfm of air and separates up to 1200 gpm of water from the exhaust stream. The water, introduced in the inlet nozzle of the separator, is used to wash all oil out of the air stream. Water separation and consequent oil separation are close to 100 per cent effective under normal operating conditions. Oil and water drop into a sump below and oil is separated by an overflow arrangement, leaving the water in condition for recirculating.

This unique combination of separation and silencing, plus oil removal, represented a noteworthy saving in equipment cost and has guaranteed continuous, uninterrupted performance with essentially no maintenance.

Revamping Old Transformers

Water-Cooled Units Have Been Salvaged, Converted To Air-Cooling — On The Job

By L. McWILLIAMS *

CHOICE of suitable types of transformers for a given installation has always been an exacting engineering problem. Due to the rapid growth on many electrical systems, the engineer of some thirty years ago could not possibly predict the requirements even ten years ahead. Also, economics entered into his problem, and he was not justified in purchasing excess transformer capacity if the load growth was uncertain.

In later years, due to unpredictable load growth in many localities, larger transformers had to be installed. This posed a problem as to what to do with the old transformers, provided they were still serviceable. Naturally, if they were of a suitable type for a smaller installation, they were installed with no further ado; however, it was frequently necessary to do considerable revamping to make a bank of transformers adaptable to another location.

This case history deals with the changes necessary to convert three 1000-kva, oil-insulated, indoor, water-cooled transformers to outdoor, self-cooled units.

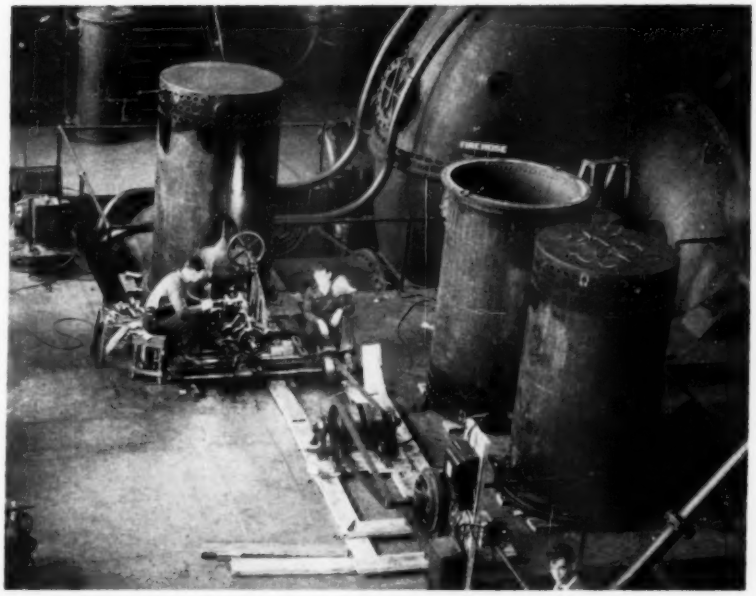


Fig. 1. View showing improvised drilling rig used to drill holes in transformer cases. Next step was to insert bent cooling tubes and weld these to the cases

Old oil-insulated, water-cooled transformers inherently had many undesirable features, and many failures could be attributed directly to faulty cooling coils. Some old transformers had iron pipe cooling coils, which were a continual cause of trouble because they literally "split at the seams." It requires very little water in insulating oil to result in a failure. On brass and copper pipe coils, corrosion occurred where the cooling coil ends came up out of the oil. In time, the corrosion ate through the pipe; hence another failure. On some transformers where the oil-level was critical, a low oil-level allowed condensation to take place, with the result that the oil shortly became contaminated.

Since the transformers in question were to be installed at an outdoor sub-station where there was no provision for cooling-water, it was decided to convert them to outdoor, self-cooled units. This, of course, meant designing and fabricating new weather-proof covers. These covers were made up from steel plate and were of welded construction. Such a job is a moderate undertaking for any shop with welding facilities.

Perhaps the most interesting feature of the entire job was the manner in which the transformer tanks were handled, in order to adapt them for their external cooling pipes which were made from 2-in. boiler tubing.

First, a sturdy I-beam frame was welded together, placed on the floor and carefully leveled. On this frame the transformer tanks rested while the drilling was being done. Some thought was given to making up a turn-table, but a 50 ton crane was available for handling and turning, so no difficulty was experienced.

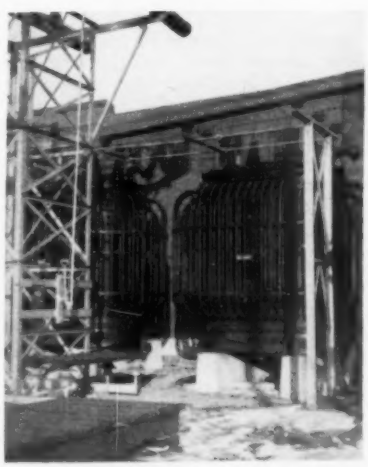


Fig. 2. Outdoor bank of converted indoor-type, water-cooled transformer

A horizontal drill was removed from its mounting in the shop and moved to the site of the job. It was set up on a steel frame that could be easily elevated or lowered to do the drilling and reaming of the 163 holes per tank. After marking off, and center-punching, all holes were drilled with a $\frac{3}{8}$-in. drill; then with a 2-in. drill. All holes were then reamed with a $2\frac{1}{32}$-in. reamer. While this work was in progress, the lengths of 2-in. boiler tube (which were to act as coolers) were bent to the proper dimensions — on a pipe bender.

Using wooden gages, the inner rows of cooling pipes were inserted, then expanded, with a boiler-tube expander. Then followed the middle and outside rows of pipes. Upon completion of this phase of the job, the tank was filled with oil to check for leaks. Fortunately none were in evidence.

Two complete banks of transformers were revamped in this manner; they have now been in service nearly fifteen years. Naturally, a considerable saving was realized in being able to adapt these old transformers to a service for which they were not originally designed. THE END

* Maintenance Supervisor.

Fig. 1. Draft tables may help in checking weight of load but are not infallible

Symbols used are identified below:

- d = density of water, lb cu ft
- D = displacement, short tons
- h = height, measuring point above water, in.
- L = length of barge
- Q = intersection of water with rake, measured from bow, in.
- V = volume displaced, cu ft
- W = width of barge, in.
- X = calculated, see Figs. 2 and 3, in.

Subscripts:

- b = bow of barge
- d = dock side
- s = stern of barge
- w = water side
- 1 = barge full
- 2 = barge empty

How Many Tons in Coal Barge?

Here's an accurate way for the power engineer to evaluate net contents of barge shipments of coal. The method is useful with or without automatic weighing devices, can correct costly errors

By BENJAMIN BLOCK *

THE DAY of the old stern wheeler paddling up the river is gone, and modern costs demand larger payloads and reduced labor requirements. Barge traffic is the modern method of river transport, with long barge "trains" covering the navigable rivers of the world. According to a statistical survey by the Corps of Engineers [1], over 12,000 dry cargo barges and scows are registered in the U. S., with a total cargo capacity of 9,000,000 short tons. With costs of other forms of transportation mounting rapidly, barge traffic is likely to become even more widespread.

As the mode of transportation has gone modern, so has the means of measuring the weight. At one time, weights were established by measurement of the barge alone; indeed, this is still true in many instances. The trend has been to weighing belts and similar contrivances. However, no mechanism is perfect; a means for spot checking barge shipments by another method is essential.

For example, your plant receives a bulk raw material by barge costing $40 per ton, which is weighed by the vendor prior to or during loading. One day his weighing mechanism malfunctions, so that the shipment is 75 tons short. Although this 75 tons represents only 5 per cent of a 1500-ton barge, the difference represents a loss to your firm of $3000; an error unintentionally made on the part of the vendor but coming out of your pocket nonetheless.

The following presentation is intended to describe an accurate means for evaluating the net contents of barge shipments. It applies to those shippers who have automatic weighing devices and the receivers of such goods, as well as to cases where displacement is the sole measuring means.

Firms engaged in barge transportation for hire are required to prepare draft tables — that is, tables listing the weight of material in the barge for increments of draft, or depth in water. Ostensibly, one might use these tables to get the weight in the barge by difference, subtracting the weight indicated by the depth of the barge when empty from that obtained when full. These tables, however, are calculated mathematically from the dimensions of the barge. As will be shown later, weights obtained in this manner may frequently be in error by over 50 tons ($2000 worth of our $40 per ton commodity).

When the determination of the weight of a body in water is mentioned, a law first encountered in elementary physics comes to mind. Known as Archimedes' Principle, it states that "a body wholly or partly submerged in a fluid experiences an upward force equal to the weight of fluid displaced." Stated more directly in relation to our problem: the weight of the barge would be equal to the weight of the volume of water displaced by it; or the weight of the contents would be the weight of the *difference* in volume of water displaced from the full to the empty condition. Utilization of this principle is, of course, the most direct route to the measurement of the barge. The problem, then, becomes the calculation of the change in submerged volume.

Two popular types of barges are shown in Fig. 2. Consider first Type A, which has a raked bow and square stern. The waterlines as shown in Fig. 3 indicate a lack of trim (levelness), particularly in the full position. The commodity which we are measuring is a solid; juggling of piles to get an exact trim would be uneconomical and is unnecessary as far as moving the barge is concerned.

For Type A, realizing that the empty and full waterlines are not parallel, the volume can best be calculated by dividing the barge into area of trapezoidal section and triangular section, as shown in Fig. 3. For the trapezoidal section, the dimension $h_s = h_{s2} - h_{s1}$, and the length is $(L - Q_2)$, which we can call Q_3. Since the change in height at the forward end from full to empty is taken

* With General Chemical Division, Allied Chemical and Dye Corp when this article was written; now with Abbott Laboratories

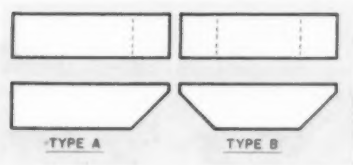
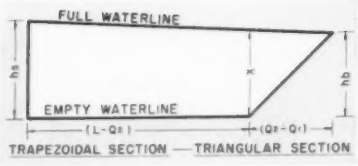


Fig. 2. Outlines of two popular types of barges; A has raked bow, square stern

Fig. 3. This is how a Type A barge would be divided for weight calculation



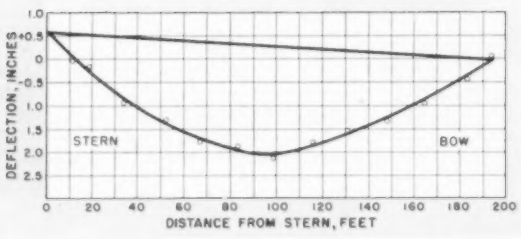


Fig. 4. This graph shows actual deflection curve based on data given in Table II. Simpson's Rule used for integration

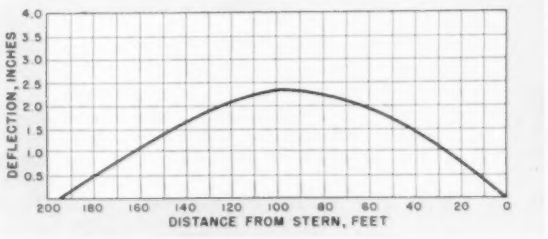


Fig. 5. Here the deflection curve of Fig. 4 has the axes translated to facilitate integration. Same 10-ft intervals

at the bow, the dimension X can best be obtained by the proportion:

1. $(h_s - h_b)/L = (h_s - X)/Q_2$

from which,

2. $X = h_s - Q_2(h_s - h_b)/L$.

The volume displaced can then be calculated,

3. $V = \frac{1}{2}(h_s + X)WQ_2 + \frac{1}{2}XW(Q_1 - Q_2)$ cu ft,

and the displacement,

4. $D = Vd/2000$ short tons.

Although the barge represented by Type B, Fig. 2, looks more complex, the displacement calculation is simpler than for Type A as long as the ends are square. Since Type B is symmetrical with regard to both the longitudinal and transverse axes, the volume can be calculated as a trapezium, and as before,

$$D = Vd/2000 \text{ short tons.}$$

Volume of the barge has now been calculated, taking into account its lack of trim and, in Type A, the lack of symmetry about the transverse axis. But there is yet a significant item to be considered [2].

If we were to float a long, inflated balloon on the water and push down on the center, the central portion would sink, but the ends would tend to remain afloat. In other words, a deflection is produced by the uneven loading applied.

An analogous condition exists in the loading of a barge. Type A, for instance, has a ballast volume under and alongside the central portion which is considerably enlarged at the stern and within the rake. The central section, then, tends to sink lower than the ends, due to the load.

Actually, it would be conceivable, if the barge were of greath length, to be able to add a given load which would produce a deflection of the central portion without a change in water level at the ends. In such a case, measurement of the water level at the bow and stern would actually show zero load. Experience has shown that the deflection accounts for 15 to 60 tons, depending on the size of the barge and the load distribution.

The volume change due to deflection can be found by sighting a straight line along the barge in the full condition and marking points at intervals along this line; when the barge is empty, a straight line is again sighted using the extreme points from the previous sighting as reference. The difference at the intervening points then gives the deflection. The volume is obtained by integrating the area which represents the deflection and multiplying by the width of the vessel. Thus,

$$V = W \int Ldh.$$

This integration can be performed graphically or by an approximate method, such as Simpson's Rule.

Here's An Example

Calculation of a barge can best be explained by the use of a specific example. Consider, then, a barge of Type A (Fig. 2) which has been measured. The log of the readings (except deflection, shown later) is given in Table I.

Table I. Log of readings for barge of Type A used in sample calculation

Location	Full	Empty
Bow deck	75.00	115.937
Bow water	74.375	116.25
Stern dock	59.00	126.50
Stern water	59.00	126.75
Q deck	107.50	234.75
Q water	111.00	230.75
Length	2339.0	
Width	420.438 (average of three points)	

Bow direction: north (this item noted as a precaution against barge being turned around).

All dimensions given in inches.

For the dock side:

$h_{1d} = 115.937 - 75.00 = 40.937$

$h_{2d} = 126.50 - 59.00 = 67.50$

$Q_{2d} = L - Q_2 = 2339.0 - 234.75 = 2104.75$

from equation 1,

$(h_{2d} - h_{1d})/L = (h_{2d} - X_d)/Q_{2d}$

$(67.50 - 40.937)/2339.0 = (67.50 - X_d)/2104.25$

from which $X_d = 43.603$.

Also, $(Q_2 - Q_1)_d = 234.75 - 107.50 = 127.25$.

Similarly, for the water side,

$h_{1w} = 41.875$

$h_{2w} = 67.75$

$Q_{2w} = 2108.25$

$X_w = 44.428$

$(Q_2 - Q_1)_w = 119.75$

Averaging the dock and water sides,

$h_s = 67.625$

$X = 44.016$

$Q_2 = 2106.25$

$(Q_2 - Q_1) = 123.50$.

From equation 3, the volume is

$$V = \tfrac{1}{2}(h_s + X)WQ_2 + \tfrac{1}{2}XW(Q_2 - Q_1)$$

$$= \frac{(67.625 + 44.016)(420.438)(2106.25)}{2 \times 1728} + \frac{(44.016)(420.428)(123.5)}{2 \times 1728}$$

$= 28{,}606.31 + 661.31 = 29{,}267.62$ cu ft

and from equation 4,

$$D = \frac{29{,}267.62 \times 62.4}{2000} = 913.15 \text{ short tons.}$$

The deflection readings were taken as described previously and were tabulated as shown in Table II.

In Figs. 4 and 5 are shown the graphs used to find the displacement due to deflection. Figure 4 is a direct plot of the data in Table II, while in Fig. 5 the axes have been translated to facilitate integration.

Taking intervals of ten feet and using Simpson's Rule for integration:

$$\text{area} = 10/3\,[(0 + 0) + 4(0.32 + 1.50 + 2.08 + 2.50 + 2.74 + 2.71 + 2.36 + 1.86 + 0.76 + 0.15) + 2(0.67 + 1.81 + 2.32 + 2.65 + 2.77 + 2.57 + 2.13 + 1.56 + 0.45)]/12$$

$= 28.27$ sq ft.

Then,

$$D = \frac{(28.27)(420.438)}{12} \times \frac{62.4}{2000} = 30.90 \text{ short tons.}$$

Total net weight = 913.15 + 30.90 = 944.05 short tons.

A tabulation of barges measured during the early part of 1957 is given in Table III. The accuracy, with possible exception of the March 5th entry, is believed to be well within the tolerance of most weighing belt conveyors, etc.

For the taking of physical measurements, simple, straightforward instruments work best. The height of the corner points above the water level can be taken by lowering a rigid pipe at the point in question and marking its length when the water level is reached. Other methods which have been devised, such as varnished sticks and tubular scales, are described elsewhere [3].

A reference mark should be made on the side of the vessel at each corner so that the height above the water is measured to the same point when full and empty. The longitudinal distance between the bow of the barge and the water line (Q_1 and Q_2) is conveniently measured by means of an L-shaped pipe form.

The horizontal portion of the form is placed under the rake parallel to the bow and is moved forward or aft until this portion of the form and the waterline coincide. The vertical part of the L then permits marking the deck of the vessel so that the distance to the bow can be measured.

If the form is constructed of aluminum conduit it will be light in weight and can be manipulated by a man on deck while a second man on the dock sights under the barge rake. Naturally, the width and length of the barge can be taken by tape measure, with the former being taken at several points and averaged.

One method of taking deflection is to mount a transit or level at one end of the barge (clamped to a vertical reinforcing strut), sight at a point at the other end of the barge, and mark along the straight line at a number of intervening points. When the barge is empty the process is repeated. Both the deflection and the distance between points are required for integration. Needless to say, some form of tie line should be provided.

Table II. Barge deflection readings

Point	Distance From Stern, ft	Deflection, in.
stern	0	—
1S	0–7″	+ 0.437
T	11′–7″	0
1N	19′–7″	− 0.281
2N	35′–7″	− 0.937
3N	51′–7″	− 1.343
4N	67′–7″	− 1.750
5N	83′–6″	− 1.937
6N	99′–6″	− 2.060
7N	115′–6″	− 1.843
8N	131′–6″	− 1.539
9N	147′–6″	− 1.250
10N	163′–6″	− 0.906
11N	183′–6″	− 0.562
ref.	193′–5″	0
bow	194′–11″	—

Table III. Tabulation of barges measured during early months of last year

Comparison of Measurement Results				
Date	Measured Wt. Short Tons	Billed Wt. Short Tons	Diff. Short Tons	Per Cent Diff.*
1/29	2253.90	2240.00	13.90	0.62
2/5	497.77	500.00	2.23	0.45
2/12	949.25	952.00	2.75	0.29
2/19	948.72	952.00	3.28	0.34
3/5	794.15	784.00	10.15	1.31

* based on billed weight

Watch Out for These

With the claim of greater than 1 per cent accuracy, made above, consideration must be given to items which affect the measurement. Realistic barge measurements are impossible under certain adverse conditions, so it is best to bring these situations into the open and realize the limitations they impose.

1. If the water is quite wavy, two sources of error are introduced. First, the average level of the water is very hard to determine. Further, if there is a swell, the roll of the barge will obviate good measurement.

2. When there is a significant wind velocity the force of the wind on the wall of the hold will depress one end of the vessel into the water, adding an additional weight to confound measurement.

3. Measurement of a barge must always be preceded by examination of the tie lines for slack. And it goes without saying that no ballast can be added or removed during the period between full and empty measurement. THE END

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By C. T. BAKER

Explosion in Ice Plant and What It Showed

LIQUID AMMONIA receiver in a 20-ton capacity ice plant exploded, doing considerable damage to the building and to a low pressure air blower. Fortunately the explosion occurred at night when the plant was shut down and no one was working on the premises at the time. An investigation following the explosion developed the following facts:

Before shutting down the compressor, the coils in both the freezing tank and small ice storage room were pumped out, according to usual procedure. In doing so, the engineer would watch the receiver gage glass and when the glass showed the receiver to be filled, the compressor would be stopped.

On this particular day, however, the engineer was called from the compressor room for a time after he had closed the king valve on the receiver. When he returned, the gage glass showed the receiver to be full, the chances being that the lower sections of the double pipe condensers were also loaded with liquid.

The receiver was small, 12 inches in diameter by ten feet in length. It was not protected by a safety valve, and was located inside the machinery room close to the wall of the building housing the machinery and freezing tank. The condensers were located outside the building next to the wall opposite to the receiver. The liquid drain connection between the condensers and receiver was one inch. The cost of a new receiver and repairs to the air blower, plus the cost of lost ammonia, was considerable.

Under the described conditions, a rise of a very few degrees in room temperature would cause the liquid in the receiver to expand, creating a rise in pressure in the vessel which, unless relieved through the one-inch pipe between the receiver and condensers, could result in dangerous over-pressure greatly in excess of the safe working pressures for this type of unfired pressure vessel.

From the foregoing case history, certain very definite facts stand out:

1. All unfired pressure vessels should be protected with dual safety valves.

2. Under no circumstances should liquid ammonia receivers be filled as described in this case. Ample room should be left for expansion of the liquid.

3. To avoid loss in shell thickness, liquid receivers should be protected against contact with water.

4. Receivers should be scraped and painted often enough to prevent rusting.

Balloon Descension

An Old Trick With a New Twist

MAN'S INGENUITY held back the tide when major piping changes were needed at a seacoast generating plant in South Carolina.

Plant Hagood, operated by the South Carolina Electric and Gas Co, uses tidewater for its condensers. To provide a positive head on the suction side of the circulating pumps, the intake and the lower portion of the discharge piping are located below low-tide level.

Discharge piping modifications involving about five days work were planned on one pump. However, these could not normally be made without first blocking and draining the seawater intake tunnels. This would have taken several days and would have meant shutting down the other two condensers for the entire period.

The alternative was to seal off the single pump's 30-in. discharge pipe in some fashion. But, how? Well, one of the piping changes planned was the installation of a butterfly valve above the pump. If this valve could be installed it could be closed against the tide. The piping above it could then be worked on with impunity.

Inflatable Plug

Engineers thought a rubber balloon might solve their problem. It could be inflated in the line as a temporary plug until the valve was installed above it. Such an inflatable plug was not commercially available so the engineers designed their own. They had a manufacturer make up a neoprene-coated nylon balloon, 30 in. in diam by 5 ft long. The balloon was equipped with handling rings, nylon ropes, and air connections. It was designed to be inflated with 15-psi air pressure.

Before proceeding with the piping changes, the engineers tested their plug. The discharge piping was opened, well above water level, and the deflated balloon lowered into position. Weights held the limp neoprene bag submerged until it was inflated and tightly engaged the pipe walls. Then the balloon was left in place through a complete tide change to check for leakage.

The neoprene seal proved satisfactory so the piping above it was dismantled and the new valve installed just above low tide level. Then, at low tide the balloon was deflated, and withdrawn through the valve. The valve was closed, and the piping modification was completed in a normal fashion.

Chemical Cleaning

This story is reminiscent of an article describing such an application in the April, 1947, issue of POWER ENGINEERING, then *Power Plant Engineering*. Dowell, Inc, after considerable research, developed balloons for the purpose of closing off condenser inflows and outfalls during chemical cleaning.

Reason for this development was that so often either valves were nonexistent or would not hold tight. This meant the loss of vast quantities of solvent by leakage during the cleaning process. In some cases reaching the location of the valves in the pipe involved the use of a great deal of extra solvent.

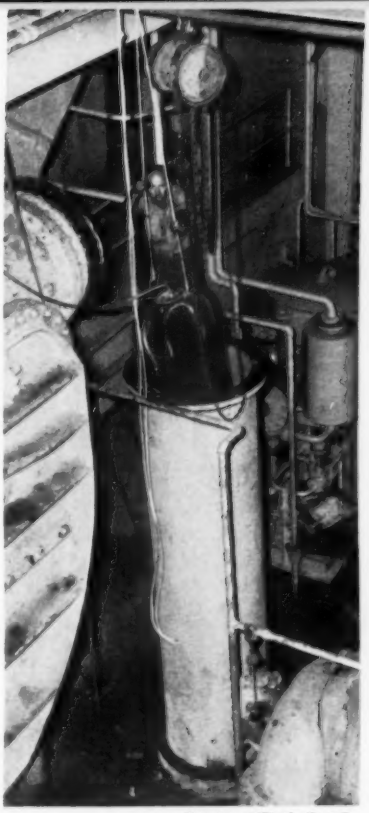
These balloons proved efficient valves, and great labor savers, eliminating the necessity of repairing old valves or installing blank flanges.

Force Resisted

Considerable heads were often encountered, ranging to 16 ft or more. Pressure in the bags was regulated to exceed the head pressure, of course. It can be readily seen, however, that with such heads over a surface of 60 in. in diam, friction between the balloon and the inside surface of the pipe had to be counted on to resist an enormous thrust, sometimes several tons.

For this reason, Dowell found it necessary upon some occasions to shore up the balloon before filling the condenser with solvent. This, of course, decreased the labor cost advantage.

In all cases, leakage proved to be negligible. The bags under pressure conformed so perfectly with the contour of the pipe interior that restriction of the liquid was nearly perfect. In one actual test, which later proved to be typical of field applications, about one gal of solvent was lost in 15 min. THE END



Courtesy of The du Pont Co.

Fig. 1. Balloon beginning its descent. It proved efficient, labor-saving valve

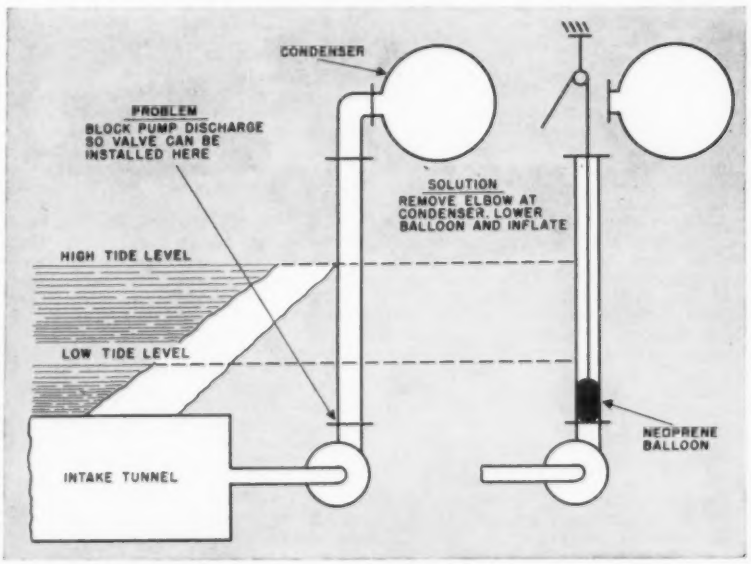
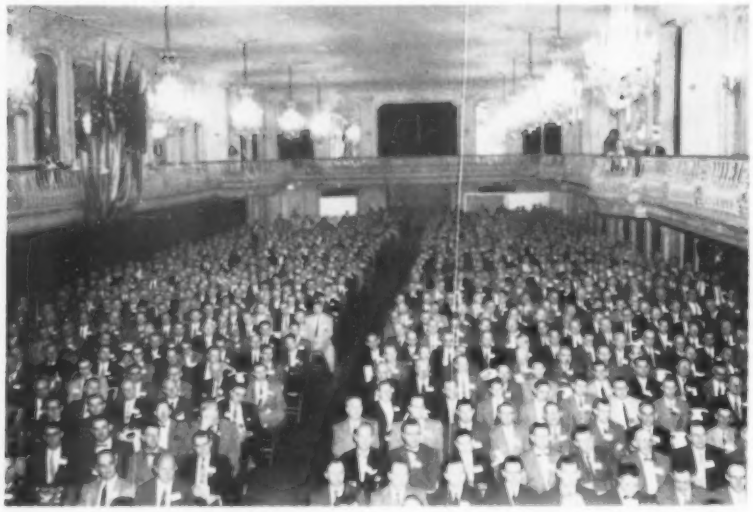


Fig. 2. Diagram of the situation in which ingenious engineers revived an old trick to stem the tide. Here, indeed, tide waited a time for man to complete his work



General view of a technical session at American Power Conference, showing the large attendance indicative of the great interest in power engineering problems covered in this conference

American Power Conference Will Bring You Up to Date on Power Problems

PRESENTING a program of technical papers packed with the latest information on the problems confronting power engineers today and anticipated in the near future, the 1958 American Power Conference will be held March 26, 27 and 28, 1958 at Hotel Sherman, Chicago, Illinois.

Program will include luncheons, the All-Engineers' Dinner, addresses by leading power engineers. Following the beginning of registration at 9:00 a.m., Wednesday, March 26, the opening meeting of the Conference will hear two addresses: one on Public Affairs — A New Dimension for Management, by Frank R. Barnett, The Richardson Foundation, Inc; the second on The Road Ahead, by Curtis L. Wilson, University of Missouri School of Mines and Metallurgy.

At noon on Wednesday, the Joint APC-ASME Luncheon, sponsored by ASME, will be addressed by J. W. McAfee, Union Electric Co. of Missouri. On Thursday, the Joint APC-AIEE luncheon will hear from Major General Charles G. Holle, Department of the Army, Office of the Chief of Engineers. Speaker for the All-Engineers' Dinner on Thursday night is to be announced. Friday noon, Halden A. Leedy, Director, Armour Research Foundation will address a joint APC-WSE luncheon.

One of the accomplishments that has been demonstrated during recent conferences has been the greater attendance by engineering students and professors. The new opportunities provided for members of this group to become better acquainted with members of the industry have been of mutual value.

This stepped up interest is the result of the efforts of the Student Attendance Committee, which has been headed since 1956 by Allen Van Wyck, president of Illinois Power Company.

Technical sessions begin immediately at 2:00 p.m. on Wednesday. A session on **Steam Turbines,** sponsored by Power Division of ASME, will hear papers on: Steam Turbines for Nuclear Power Plants, J. A. Carlson, Large Turbine Engineering Department, Westinghouse Electric Corp; High Temperature Steam Turbine Design Improvements from Operating Experience. E. P. Hansen, A. C. Holmes, and J. J. Fleischmann, Steam Turbine Department, Allis-Chalmers Manufacturing Co; Turbine Generators for the '60's, C. E. Kilbourne, Product Planning and Marketing Research and C. W. Elston, Large Steam Turbine Generator Department, General Electric Co.

Industrial Plants will be discussed in one session as follows: Design of Small Industrial Power Plants to Secure Maximum Net Earnings, Andrew A. Cummins, Cummins & Barnard, Inc; New Ideas for Industrial Boiler Plant Coal Handling, Arthur J. Stock, President, Stock Equipment Co; Short-Cut Methods of Quickly Evaluating Alternate Steam and Power Supplies for Industrial Plants, W. B. Wilson and D. L. E. Jacobs, Power Generation Engineering, Engineering Planning and Development Section, General Electric Co.

Fuels Session, sponsored by the Fuels Division of ASME, will have these papers: Energy Aspects of Underground Gasification Processes. Coultas D. Pears, Southern Research Institute, John Capp, U. S. Bureau of Mines, and Milton H. Fies, Alabama Power Co.; Economic Trends Affecting Transportation of Energy, S. B. Smith, Ebasco Services Inc; Fuel Availability and Future Power Demand, Harlan W. Nelson, Battelle Memorial Institute; Future Outlook for High Energy Liquid Fuels. C. C. Miesse and Paul Lieberman, Combustion Research Section, Armour Research Foundation.

Feature of **Hydroelectric Power** Session I will be a **Symposium on Pumped Storage,** with these participants: Pumped Storage Economics, George R. Rich, Charles T. Main, Inc. and Partner, Uhl, Hall and Rich (Affiliate of Charles T. Main, Inc.); Planning for Pumped Storage, E. S. Loane, General Public Utilities Corp; Application of Pumped Storage Hydro to Midwestern Terrain, G. J. Vencill, Union Electric Co; Operating Experiences with Large Pumps at Grand Coulee Dam. Glenn R. Barker, U. S. Bureau of Reclamation.

Gas Turbines will be treated by these papers: Gas Turbine in the Industrial Steam Power Cycle, J. E. Parker, Union Carbide Chemicals Co; How to Integrate Gas Turbines with Other Generation in an Economical Utility Generating System, W. D. Marsh, General Electric Co; Gas Turbines as an Economic Generating Source, W. H. Ferguson, Industry Engineering Department, and R. E. Strong, Gas Turbine Department, Westinghouse Electric Corp.

Water Technology Session I will feature a **Panel Discussion on Deaeration**: Deaerators — Manufacturers' Viewpoint, Ralph M. Lemen, The

Allen Van Wyck, president, Illinois Power Co, and chairman, Student Attendance Committee for Conference

Permutit Co; Condenser Hotwells — Manufacturers' Viewpoint, R. A. Wilson, Allis-Chalmers Manufacturing Co; Deaeration — Boiler Manufacturers' Viewpoint, H. A. Grabowski, Combustion Engineering Co; Deaerators — Operator's Viewpoint, John R. Bryan, Union Electric Co; Condenser Hotwells — Operator's Viewpoint, A. M. Guy, Southern Indiana Gas and Electric Co; Deaeration — Design Engineer's Viewpoint, W. R. Steur, Sargent & Lundy.

Water Technology Session II will cover Ion Exchange in the following papers: High-Temperature (475 F) Cation Exchanger Data, C. F. Paulson, Atomic Power Division, Westinghouse Electric Corp, and C. E. Johnson, National Aluminate Corp; Effect of Dissolved Oxygen on Some Performance Characteristics of Weak and Strong Base Anion Exchangers, Irving B. Abrams, B. N. Dickinsen and M. R. Roberts, Chemical Process Co; Comparison of Mixed Bed and Four Bed Demineralizers, F. B. Wink, Niagara Mohawk Power Corp, and Durando Miller, The Permutit Co; Demineralizer Treating Hot Lime Zeolite Effluent, A. K. Sukumar, Ford Motor Co, and S. B. Applebaum, Cochrane Corp.

Water Technology Session III will cover water problems in nuclear power.

Final 4th Session on **Water Technology** will hear about: Continuous Recording Sodium Flame Photometer for Extremely Pure Waters or Steam, William Nacousky and Willard A. Crandall, Consolidated Edison Co, and another paper to be announced.

Central Station Problems will be covered by these papers: Operating Experience with the First Commercial Supercritical Pressure Steam-Electric Generating Unit at the Philo Plant, T. T. Frankenburg, A. G. Lloyd and E. B. Morris, American Gas and Electric Service Corp; Operating Experience with the First Commercial Universal Pressure Steam Generator at Philo, J. D. Andrews, Jr. and P. H. Koch, and E. A. Pirsh, Boiler Division, Babcock and Wilcox Co; Operating Experience with the First Commercial Supercritical Pressure Steam Turbine Built for the Philo Plant, R. Sheppard, Large Steam-Turbine Generator Department, Genera Electric Co; How to Reduce the Hazard of Inoperative Check Valves, L. H. Carr, Edward Valves Inc., Rockwell Manufacturing Co; The Turbo-Furnace for Multifuel Firing, C. F. Hawley, Riley Stoker Corp; From Boiler Boil-Out to Operating Date, J. A. Donald, N. A. Miller, and C. D. Blanke, Sargent & Lundy; Vulnerability of a Central Station Power Plant to Attack by a Nuclear Weapon, David B. Singer, Armour Research Foundation.

Nuclear Energy: — Progress report on nuclear developments in the electric power industry will be held in the Grand Ballroom at 7:30 P.M., Wednesday evening. Executives of a number of electric utility companies will describe the current status of the various nuclear reactor projects in which their companies are participating, and discuss their plans for future research and development.

Other aspects of nuclear energy will be covered in two other sessions.

Electrical problems will be thoroughly covered in several outstanding sessions. **Electrical Industrial Session** will have papers on: Automation and Programming Control for Industrial Processes, W. R. Harris, Industry Engineering, Westinghouse Electric Corp; Effect of Voltage Transcients on Industrial Control and Utilization Equipment, G. W. Walsh, Power Systems Engineer, General Electric Co.

In **Transmission Engineering,** Reducing Transmission System Costs and Losses will be covered by Merrill DeMerit, and K. E. Hapgood, Tennessee Valley Authority; and Electric Power Production and Marketing Activities of the Department of the Interior by K. J. Plucknett, Office of Assistant Secretary for Water and Power Development, U. S. Department of the Interior; The Edison 345 kv Interconnection with A. G. & E, by Ludwig F. Lischer, Commonwealth Edison Co; The German 400-kv System, by W. Fleischer, Deutsche Verbundgesellschaft e.V.; Lightning Performance of High Voltage Lines, by Julius Hagenguth, Power Transformer Department, General Electric Co.

Distribution Equipment session will hear: Substation Application of Reclosers, by Frank W. McStay, Kyle Switchgear, Line Material Industries; Application of Vacuum Switches to Utility Loads, by J. W. Rittenhouse, Hi-Voltage Equipment Co.

Symposium on Computers and Network Analyzers will consist of these papers: Engineering Computations for Bonneville Power Administration by J. R. Curtin, Bonneville Power Administration; Purchase, Annual Lease, or Hourly Rental of Digital Computers, by E. F. George, Ebasco Services, Inc.; Digital Computer Solution of Power System Problems by H. P. St. Clair, and G. W. Stagg, American Gas and Electric Service Corp; Electric Utility Problems Programmed for Digital Computers, by Frank J. Maginnis, Analytical Engineering, General Electric Co. Symposium on Scheduling and Billing of Economy Interchange on Interconnected Power Systems will include these participants: Practices on the Single Area Pennsylvania-New Jersey-Maryland Interconnection, H. Webster Phillips, Penna — NJ — Md Interconnection; Practices on the Multiple Area North-East Interconnection, W. D. Wilder, Niagara Mohawk Power Corp; Practices on the A. G. & E. System, A. H. Willennar, American Gas & Electric Service Corp; Practices on a Pool that is Part of a Large Interconnection, E. K. Corporon, Interchange Power Services, Inc.

Power Transformers will be discussed as follows: Power Transformer Applications by Clark L. Rose, Bureau of Reclamation; Power Transformers with Reduced BIL's by Fred J. Vogel, Allis-Chalmers Manufacturing Co; Millions Saved by Utilizing Increased Transformer Capabilities by Knute J. Falck, Philadelphia Electric Co; Dual Voltage Distribution Transformers by R. D. Nelson, R T & E Corp.

When You Are At the American Power Conference

Hotel Sherman, Chicago, Illinois, March 26, 27, 28

THE EDITORS of Power Engineering cordially invite you to drop in at our Hospitality Suite in the Hotel Sherman for refreshments, coffee or a rest. Use our suite as a place to meet friends or to make new ones. We will welcome you between or after sessions 9:00 a. m. to midnight. Ask at the hotel registration desk for our room number.

Manufacturers' Representatives Available During American Power Conference

MANY ENGINEERS attending the American Power Conference, especially those from other parts of the country, have often desired to include in their trip a consultation with some representative of a particular manufacturer on technical or business matters.

To help them do this, the editors of POWER ENGINEERING, as a strictly editorial service, without obligation, are listing below the names of various companies, their representatives and the hotels where they can be reached during the Conference. These names will be posted on a bulletin board near the Conference registration desk. Their room numbers will be posted when available. This same information will also be on file in POWER ENGINEERING's suite for the convenience of visitors there.

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continued on next page

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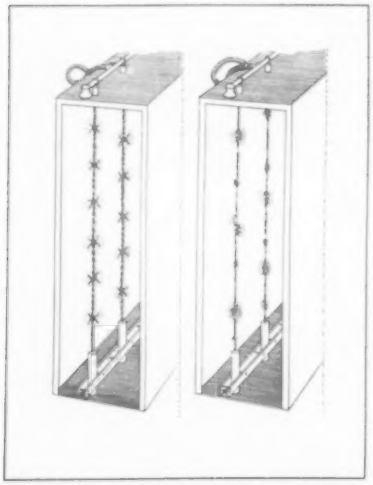
New Electrode Raises Efficiency of Precipitators

SUCCESSFUL use of a new type of electrode in the field of industrial gas cleaning and air pollution control has been announced by the Metal Products Division of Koppers Co, Inc.



Barbed electrode shown on left affords constant control of corona, permitting higher power levels, better efficiency

Disclosure of the new device was coupled with announcement that it has been performing successfully for approximately a year in a major steel plant in this country, at a large power generating plant in England and in cement plants in Germany and Hong Kong. Koppers has accepted contracts for installations in large industrial plants.

Recognized as the most efficient means of cleaning industrial gases, both for control of air pollution and in the recovery of valuable components, the electrostatic precipitator removes solids from flue gases by subjecting them to an electrical charge.

How Precipitator Works

As the gases pass through the precipitator "fields," the solid particles receive a negative charge from wire energizing electrodes and are then attracted to grounded collecting plates. The efficiency of the unit is in direct proportion to the power that can be introduced into the energizing electrodes without a "flash-over" to the collecting plates.

Uneven Build-up

Collected material tends to build up on the surface of these plates and must be dislodged by frequent, automatic rapping to minimize its insulating effect.

To a lesser degree this build-up also occurs on the energizing wire electrodes, and here its insulating effect tends to produce an unpredictable and uncontrolled pattern in the corona discharge which is the key factor in the precipitating action.

Even though the energizing electrodes also are rapped at frequent intervals, no way had been found to prevent uneven accumulation of dust and hence an uncontrolled corona discharge.

New application solves this problem — which has plagued precipitator manufacturers for almost half a century — by substituting for the conventional straight-wire energizer an electrode which closely resembles ordinary barbed wire.

Suspended vertically between the collecting plates, the new wire has demonstrated that, whatever insulating material may build up on the main wire, the barb points remain clean and the corona discharge, therefore, occurs constantly at those points.

By proper spacing of these barbs complete control of the corona discharge can be achieved, it is stated, throughout the entire precipitator.

Two years of investigation followed two failures in steam turbine rotors. Cracks were found in others. Results are improvements in groove design, blade fastenings, and heat treatment

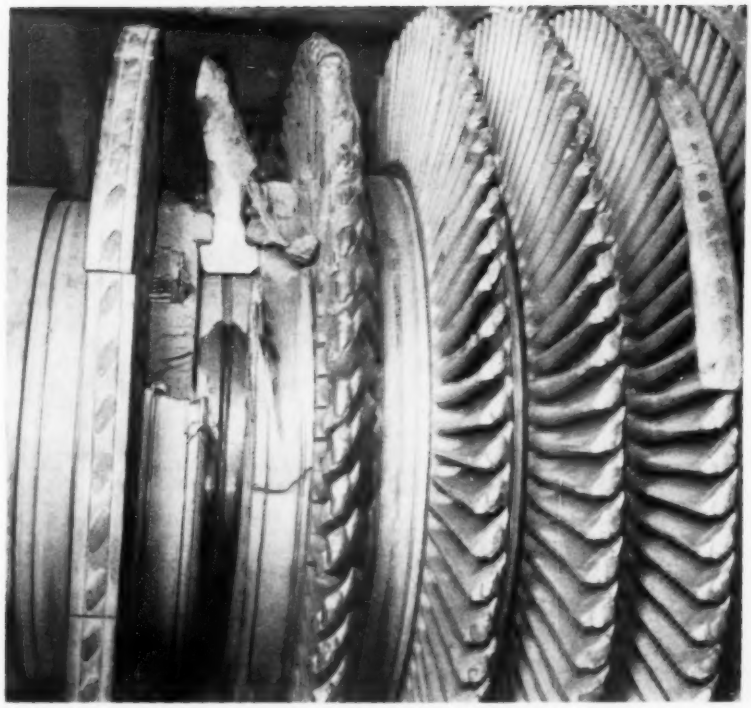


Fig. 1. Portion of damaged Weadock rotor. Total of eight rows were seriously enough damaged to require removal

Investigation of Rotor Failures Brings Design Improvements

TWO EXPERIENCES involving cracking in turbine-rotor blade-groove walls prompted Westinghouse to initiate an intensive investigation of these and all similar rotors. Results indicated changes in heat treatment and in the design of blade fastenings would be advantageous. This is the story of the investigation and the subsequent changes.*

First incident took place at Shawnee Station of TVA, and the second at Weadock Station of Consumers Power Co, Jackson, Mich.

Inspection of Rotors

Immediately after the Weadock experience, owners of similar machines were requested to reduce the reheat temperature about 50 F until an inspection could be made. During the past two years, ten other rotors made of the chromium-molybdenum-vanadium steel material have been inspected after service periods up to 13,000 hours. Pertinent design data, operating conditions, and results of the inspections were tabulated. Two of the rotors inspected were virtual duplicates of the Weadock rotor. Two different heat treatments were represented by the rotors inspected.

It was found that two other rotors had cracks, and that both of these used a similar heat treatment. None of the rotors using a 1750 F heat treatment instead of the 1850 F had any crack, including one which was a near duplicate of Weadock, and which had run nearly as long.

Prior to 1953 all high temperature rotors used by Westinghouse were made of a nickel-chromium-molybdenum-vanadium steel. This material was made with some variations in chemical composition and heat treatment. In general, it had been found to be very satisfactory with metal temperatures in the 850 to 950 F range.

Shawnee No. 1

One form of this material had been made in 18-in. diam forgings and extensively tested at 1000 F with very good results. Prior to the adoption of the chromium-molybdenum-vanadium steel described above, this form of the nickel-chromium-molybdenum-vanadium steel was applied to a number of rotors for operation with metal temperatures near 1000 F. Among these machines was the i-p element of the Shawnee No. 1 unit of the TVA system. This machine is similar to Weadock except the i-p groove wall stresses are much lower.

Shortly before the Weadock mishap, this TVA machine was being modified for reasons unrelated to the rotor problem. At that time, the first row of rotor blades were found to be leaning. On removal of the blades, the groove walls on each side of the row were found to be cracked. The crack extended the entire circumference on the inlet side and was about half way through the wall adjacent to the entering slot. The crack on the outlet side was of short length and relatively shallow.

Chemical composition of this rotor forging is as follows:

Carbon	0.28	per cent
Manganese	0.75	per cent
Phosphorus	0.030	per cent
Sulfur	0.027	per cent
Silicon	0.25	per cent
Nickel	2.71	per cent
Chromium	1.07	per cent
Molybdenum	0.56	per cent
Vanadium	0.21	per cent

Forging had been heat-treated during manufacture as follows:

After all forging had been completed, the forging was equalized at 1300 F for 14 hours, and control cooled to 460 F, and held at 460 F for 24 hours. It was reheated to 1640 F and held for 36 hours, and air cooled to 1200 F, then control cooled to 460 F, and equalized at 460 F for 24 hours. It was then reheated to 1220 F and held

* This is a condensation of "Operating Experiences with High Temperature Steam Turbine Rotors and Design Improvements in Rotor Blade Fastening" by Joseph D. Conrad and N. L. Mochel. ASME Paper No. 57-PWR-10.

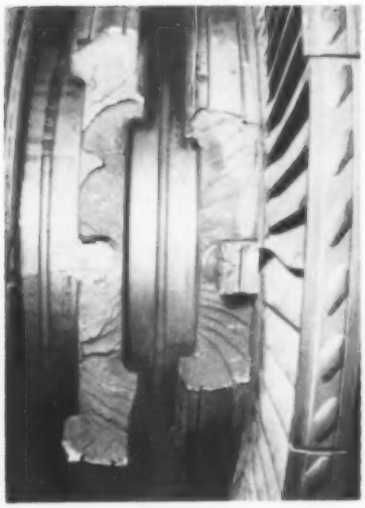


Fig. 2. Close-up of failure indicates occurrence at location on circumference of blade-entering slots for rows 1 and 3

for 36 hours, and control cooled to 400 F, and then air cooled.

Forging was then rough turned, faced and bored. It was reheated to 1600 F, held for 32 hours, and air cooled to 460 F, and equalized at 460 F for 30 hours. It was then reheated to 1140 F, held for 45 hours, and furnace cooled to 600 F, followed by cooling to room temperature in air.

It was then rough machined to forging drawing size, and stress-relieved by heating to 1150 F, held for 38 hours, and furnace cooled to 450 F, then air cooled to room temperature.

Failing to meet the specified physical properties, the forging was retreated as follows: It was reheated to 1600 F, and held for 32 hours, and air cooled to 450 F, and equalized at 450 F for 16 hours. It was then reheated to 1160 F, held for 38 hours, and furnace cooled to 450 F, then air cooled to room temperature.

Other Rotors Inspected

Seventeen other rotors made of this material have been inspected during the past two years. These rotors had been in operation for periods up to 58,000 hours. For most machines, the operating time was considerably longer than for the previously discussed group of machines.

Eleven of the additional rotors had cracks and six had none. The depth of the cracks varied from 0.020 in. to $1\frac{1}{4}$ in. Two machines had cracks as far down the rotor as the 900 F zone.

A study of the stresses, operating temperatures and time before cracking occurred, shows that this material must have a wide scatter in creep rupture properties. Core specimens were taken from all rotors inspected and creep rupture tests are being made. Results from these tests also indicate a wide variation in creep rupture properties.

Time and Temperature Effects

From one rotor which had operated about two-and-one-half years, specimens were taken from the hot end and the cold end, both from points of low stresses. Those from the hot end showed about one-third lower rupture strength than those from the cold end. There appears to be a deterioration of this material with time and temperature at least in the 950 F to 1000 F zone.

Weadock Incident

Mishap on the Weadock No. 7 turbine took place on November 6, 1955. It consisted of a groove-wall failure at the second blade row of the intermediate-pressure spindle. This is a 156,250-kw unit, single-shaft, tandem-compound, three-casing, triple-exhaust, 3600-rpm. It is designed for initial steam conditions of 2000 psig, 1050 F, with reheat to 1000 F.

Reheated steam is admitted ahead of the first stage of the i-p spindle. This i-p element contains all of the intermediate-pressure stages following the reheat point, and one of the three sets of low-pressure exhaust blades. The unit had been in service for seven months when the incident occurred.

Machine had been operating very smoothly. However, it developed an increasing amount of vibration over a period of five days immediately before the mishap occurred. The vibration was somewhat spasmodic in magnitude finally reaching a double amplitude of 7 mils, thus demonstrating that this was a progressive failure rather than an explosive one. Successive surges of vibration were probably created as progressive cracking allowed the blades to lean and permitted shrouds to rub.

Fracture was of the creep-to-rupture type, and took place along sections AA, BB, and BC in Fig. 3 and extended around the circumference about eight in. The part above AA was completely broken out and that above BC almost broken out in a manner to let nine blades come out of the rotor.

Blade-entering slots for successive rotating rows are diametrically opposite one another. This fracture, adjacent to row two, was at the location of entering slots of rows one and three shown by dotted lines in Fig. 3. Groove wall stresses are higher than average at this circumferential location. The stress across section BB is increased by the extra load of the closing blade in row three, transmitted through the serrated breech block.

Stresses across section AA and BC are increased by the cutting of these sections for the entering slots of rows one and three respectively. Photographs of the failed rotor groove wall are shown in Figs. 1 and 2.

Stresses at the point of failure were higher than normally allowed at this reheat operating temperature due to an unusual combination of blade size, row spacing and radial step-up between rows. In combination, this resulted in too thin a wall at both AA and BB. This condition was created and not fully checked when a previously established design was modified for lower reheat and crossover pressures. Concentration of load due to breech-block loading was also above normal, due to use of a wider-than-necessary entering slot taken from a larger pitch blade using the same fastening.

Temporary Repair

Eight stages of blading immediately following the reheat point were sufficiently damaged to require removal. The material between the blade root grooves was machined out to provide specimens for a full metallurgical investigation. The machine was returned to service in five weeks without these eight stages and with the reheat temperature limited to 850 F. The interceptor valves were adjusted to prevent them opening wide in order to compensate for unbalance in thrust brought about by omission of the eight stages.

Machine was found to operate satisfactorily up to 170,000 kw. However, to provide a large margin of safety, the load was limited to 145,000 kw (93 per cent rated capability) until the rotor was replaced about one year later.

The rotor was made of chromium-molydbenum-vanadium steel of the following composition.

Carbon	0.32	per cent
Manganese	0.74	"
Phosphorus	0.037	"
Sulfur	0.036	"
Silicon	0.25	"
Chromium	1.04	"
Molybdenum	1.20	"
Vanadium	0.24	"
Nickel	0.34	"

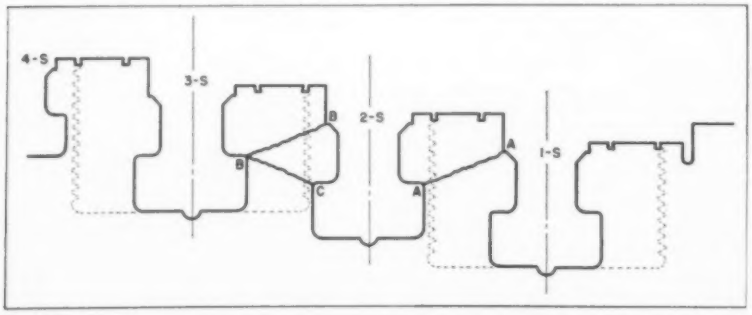


Fig. 3. Cross-section of blade grooves showing lines of failure in Weadock rotor

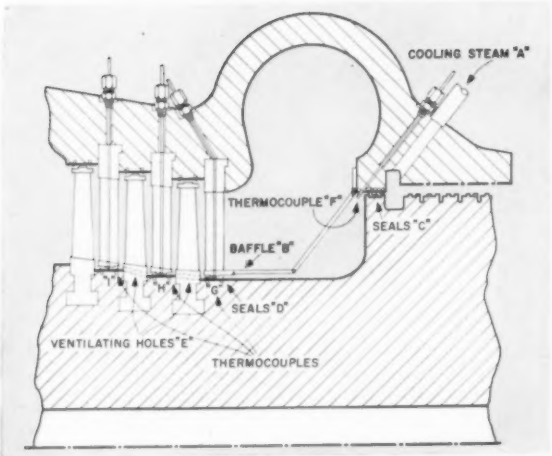


Fig. 4. Drawing of modifications to lower rotor temperature

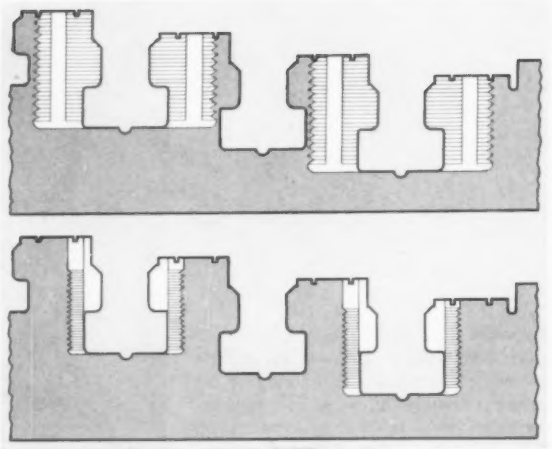


Fig. 5. Comparison of blade-entering slots before and after

Three-cylinder triple-exhaust machines of both the TVA basic frame and the Weadock modification have an important difference as compared to Westinghouse two-cylinder reheat machines. A portion of the rotor in the former is exposed to the full 1000 F reheat steam between the first stage and dummy. In the two-cylinder machine the 1000 F reheat steam passes through the first stage and decreases in temperature before contacting the rotor. Also, the rotor right up to the first stage is cooled by the gland steam leakage from the high-pressure exhaust (cold reheat steam.)

This reduces the temperature at the point of highest stress on the inlet side of the first row. Stratification of this leakage steam along the tips of stationary blades can effect some cooling for several stages. Also, heat flow in the spindle towards the cooler sections in both directions creates a gradient which gives a lower temperature at the higher-stressed points between rows one and two.

Temperature at the critical point is about 50 F lower in the two-cylinder machine. It is noteworthy that no cracking has thus far taken place in any two-cylinder rotor of this design.

Modifying Existing Turbines

A fairly simple modification has been made on three-cylinder machines to accomplish this cooling. Fig. 4 shows this modification. These machines already had cold reheat steam from the h-p exhaust introduced at A to supply the dummy leakage, thereby reducing the temperature of the dummy seals, gland seals, and cylinder end wall. The modification consists of:

1. Addition of baffle B
2. Increase of seal clearance at C
3. Elimination of seals at D
4. Enlarging the orifice in cooling steam supply line
5. Drilling of holes through base of blades at E
6. Installation of thermocouples at F, G, H and I to determine the amount of cooling

In addition to cooling, several modifications were made to reduce the stress. These include:

1. The replacement of several critical rows with lighter blades made of higher strength material
2. Alteration of blade roots to reduce weight
3. Omission of closing blade in critical rows
4. Alteration of locking pieces to reduce weight
5. Increase of groove fillets and improvement of groove wall finish to reduce stress concentration
6. Addition of a fillet in the bottom of the serration in entering slots to reduce stress concentration

Limited operating experience with machines upon which these modifications have been performed has produced favorable results.

New Machines

On new machines, Westinghouse is restricting the use of the nickel-chromium-molybdenum-vanadium steel to rotors where the metal temperature is 900 F or less, and have reduced the allowable stress in the temperature bracket from 800 F to 900 F. For rotors with metal temperatures over 900 F, they are using the chromium-molybdenum-vanadium steel with the revised heat treatment. Research work is now in progress to determine the optimum heat treatment.

Fig. 6 shows the new locking device. This device is shown in three stages of assembly. The two pairs of half round pieces are made in jig fixtures to assure accuracy of matching of serrations between the parts. The closing blade of a row is inserted radially with the shorter serrated pieces in the rotor notch and the longer serrated pieces in the blade root notch. The projection at the top of each piece in the blade root allows the assembly to be brought into exact position for rotating the parts and closing the lock.

Fig. 5 shows the contrast of groove wall slotting for the old and the new locking device. It is believed that the maximum stress at the locking device is reduced by $\frac{1}{3}$ by use of this device. THE END

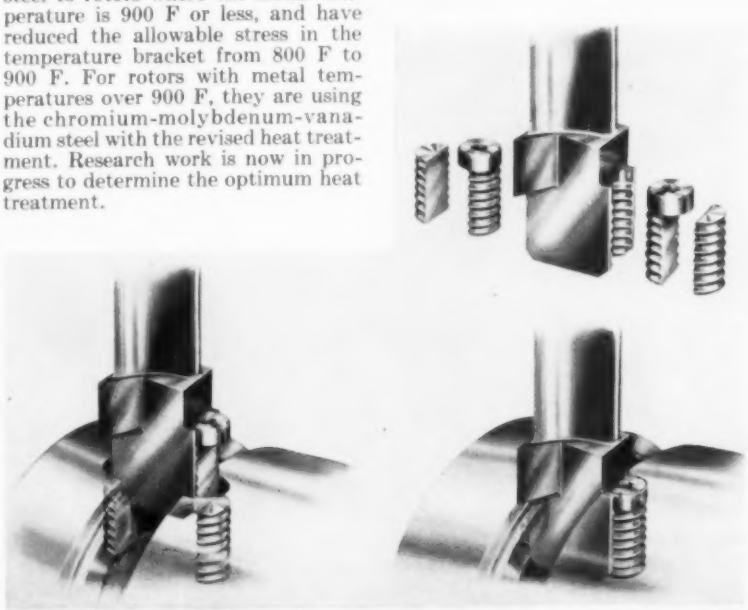
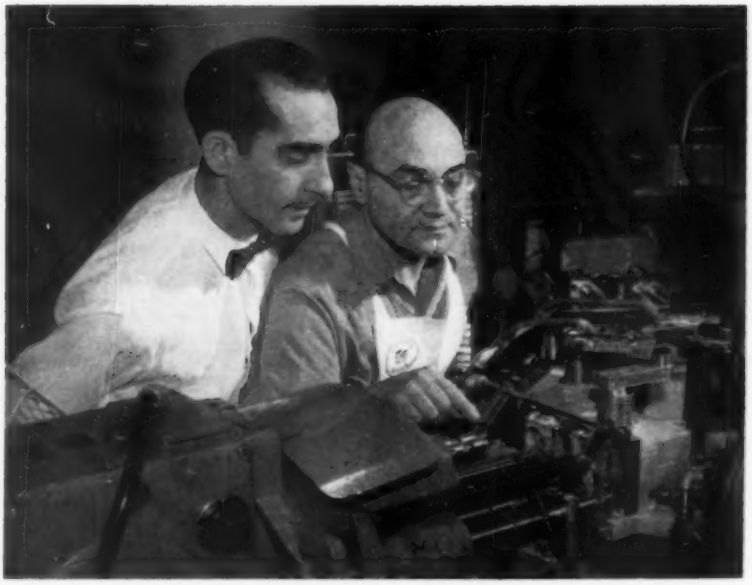


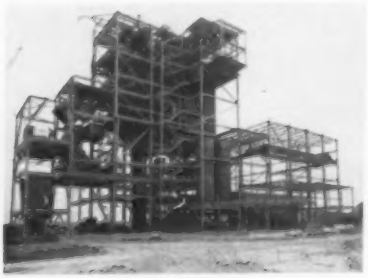
Fig. 6. Drawing showing new blade-locking device in three stages of assembly



He won $23,495. To Anthony Vassallo, left, went highest suggestion award ever made an employee by Eastman Kodak Co. Vassallo's suggestion combined several operations on one machine. Here he checks set-up with operator Samuel Loiacono

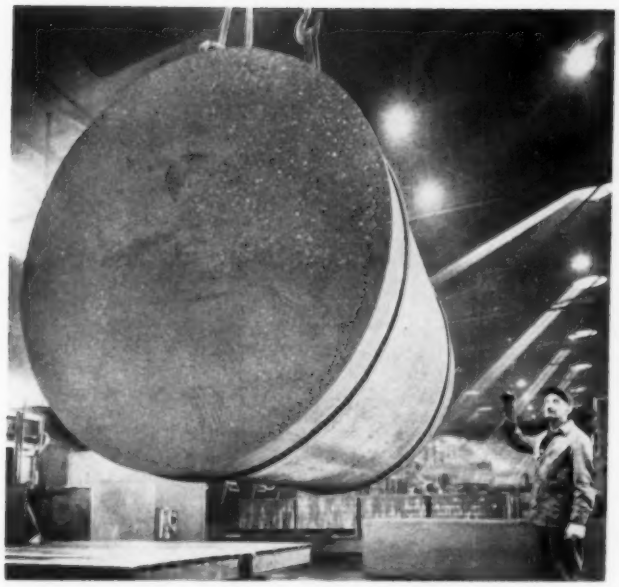
POWER ENGINEERING'S

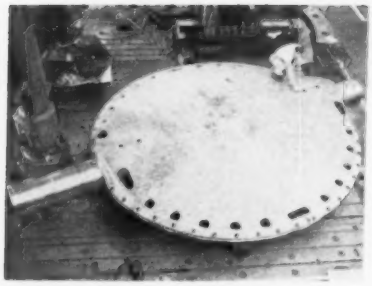
Model in pastry helps celebrate 25th birthday of modern step-type utility voltage regulator. Philip Sporn, president of American Gas & Electric Co, cuts cake with Raymond W. Smith of G.-E. Device was suggested by Sporn



Under construction is Unit 1 of Port Wentworth Station of Savannah Electric & Power Co, Ga. Of 40,000 kw capacity, unit will have heat rate of only about 10,000 Btu per kwh

Now ready for operating at full planned capacity, TVA's John Sevier Steam Plant near Rogersville, Tenn., has completed installation of its fourth 200,000-kw turbine-generator unit. No. 4 is the first TVA steam generating unit to be financed entirely from power revenues. It cost approximately $24,000,000

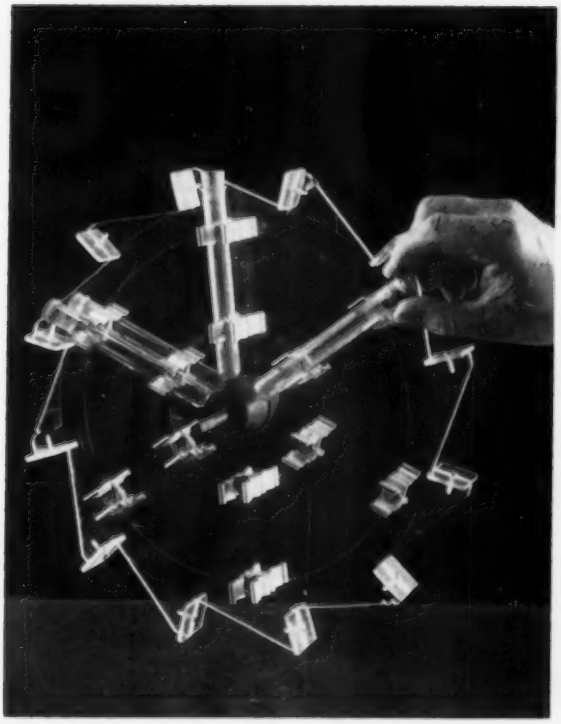


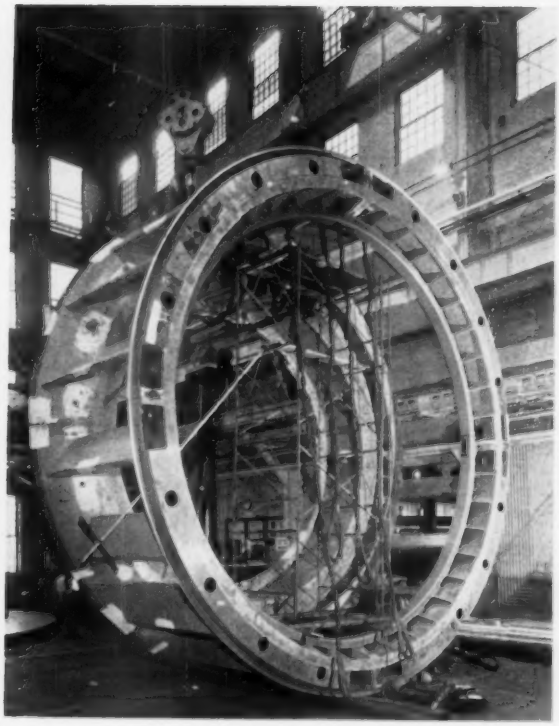


How big can they get? Butterfly valve has 17-ft diameter, serves penstock at the Merwin Plant dam in Washington. Allis-Chalmers made it

Biggest carbon electrode ever made is this 10-ton giant with diameter more than 5 ft. National Carbon Co developed it for use in mammoth submerged arc furnaces now being designed to use as much as 50,000 kva

NEWS REEL





What kind of a wheel is it? The above photograph and the one alongside present an interesting study of circular form in industrial design. Can you identify each? The object above is a photo paddle wheel, a plastic device which Kodak uses to hold small quantities of exposed film used in controlling quality. Turned by flow of cold water, the wheel agitates small quantities of developer in the attached test tubes and insures uniform development of the film. At right is an Allis-Chalmers combination stay ring and discharge ring made for an hydraulic turbine. It stands 13 ft high

Butterfly Valve Controls Condenser Siphon

BY T. H. SEITZ *

APPLYING a butterfly valve control from condenser water box vacuum is expected to result in sizable savings in initial as well as operating costs at the new George F. Weaton steam power plant of the St. Joseph Lead Company at Josephtown, Penna.

Designed and now under construction by Kaiser Engineers, the 100,000-kw plant will supply power to the company's nearby zinc-smelting plant. Sufficient generating capacity is assured to meet both existing requirements of the present zinc-smelting operation and planned expansion.

After studying equipment and operating costs while designing the power plant, the engineers decided that substantial savings could be made by choosing butterfly valve control over the more conventional seal well for siphon control without sacrificing dependability.

This solution to the problem of circulating water siphon control warrants study whenever the difference in elevation between condenser water box and discharge pool exceeds the maximum vacuum allowable to keep the condenser from running dry. Operating a steam condenser without cooling water for even a few minutes may result in leaks requiring an extended shutdown.

Conditions at the St. Joseph power plant site indicated that there would be a difference of 46 ft in elevation between low river stage and the top of the condensers at the high point of the system. This arrangement is indicated schematically in Fig. 2.

Control of Siphon

It is apparent this arrangement suggests the use of siphonage to cut first, as well as operating, costs of pumping equipment. But it is also clear that some way must be found to prevent siphon effect from increasing so much that the condenser may be drained of cooling water.

It is accepted practice to take advantage of such available siphoning effect by using a seal well on the outfall line. Overflow of the well is normally set at such an elevation that a safe vacuum cannot be exceeded at any flow rate from zero to the design value of flow. This arrangement means that the overflow will be fixed at a point considerably above the discharge pool water surface.

There are, however, two disadvantages inherent in this setup. First, variation of river stage affects the point on the characteristic at which the circulating pumps operate. Thus, flow varies with river stage. Second, there is a difference in elevation between the seal well overflow weir and the river stage. This serves no useful purpose to the system. Instead, the potential energy available is wasted in free fall and dissipated in the discharge pool.

These disadvantages can be eliminated by a continuous piping system. It must be designed so the outfall has enough friction loss to dissipate the elevation head in excess of that required for siphon action. An increase in river stage will produce two effects in such a system: less pump head will be needed to lift water to the condenser; head available for overcoming outfall friction will be decreased an amount equal to the pump head reduction.

How It Works

This is illustrated by the hydraulic grade line diagram. Three hydraulic grade lines are presented to indicate the effect of river stage on the pressure level at any point in the system. Each shows the increase in head provided by the circulating pumps, followed by its dissipation in intake line, condenser tube, outfall line, and butterfly valve friction.

Siphonage imposed on the condenser outlet water box may be directly scaled from the difference

* Registered Professional Engineer, Associate Engineer, Kaiser Engineers Division of Henry J. Kaiser Co, Oakland, Calif.

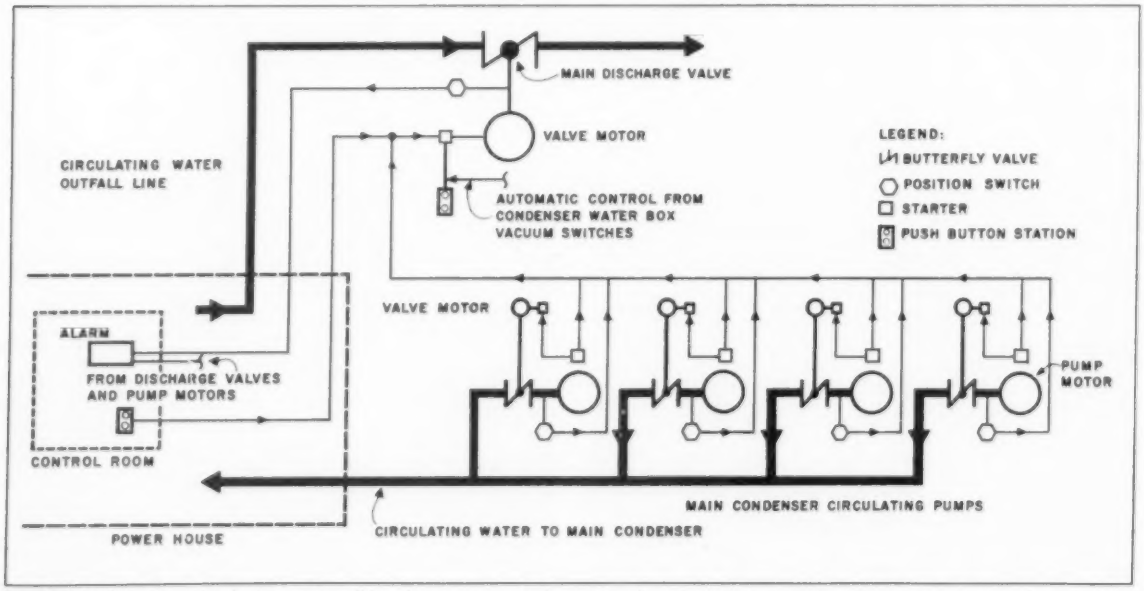


Fig. 1. Combination circulating-water flow diagram and schematic of control system and alarm wiring. Interlocks are thus:

1, Main discharge valve can be closed from control room only when any one pump discharge valve is open and its respective pump running; 2, Main discharge valve will close automatically when all of the discharge valves are closed or all of the pump motors stop; 3, All pump discharge valves and pump motors can be operated from the control room in addition to local control; 4, An alarm is sounded when the main discharge valve is completely closed; 5, An alarm is sounded when a pump discharge valve is not fully open. All of the alarms are located in the control room at the switches

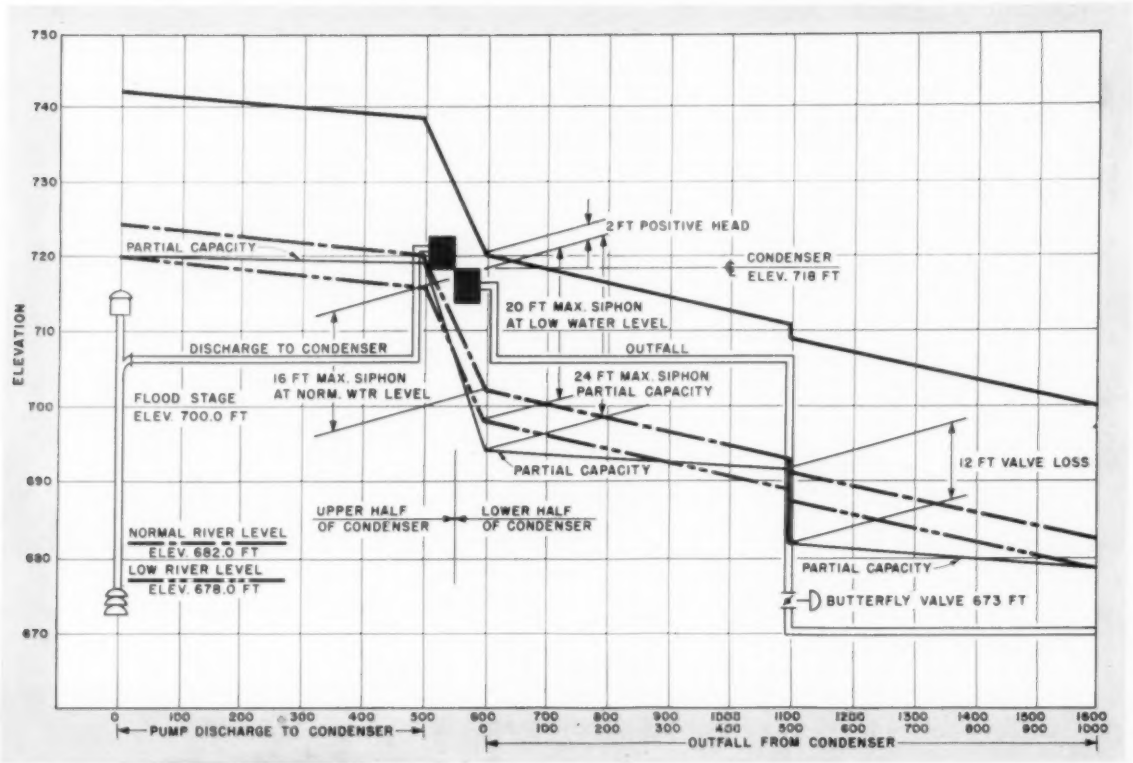


Fig. 2. Hydraulic grade line diagram illustrates variations in level and head which necessitate special control of siphon

between physical elevation and elevation of the hydraulic grade line at the same location. This siphon effect is maximum at low water and partial capacity (approximately 50 per cent is assumed). It is clearly indicated that the pressure level increases throughout with rise of river level so there is a positive pressure rather than a siphon effect at high river stage and full pump discharge rate.

In any case, the pump must be specified for the head requirement at low river stage, while allowable siphon effects may then be determinded by economics and experience. Excess available head should be dissipated in the outfall friction.

The result of these considerations will be a variation in condenser water box vacuum because of siphonage. Variation will be maximum at low water and minimum at high river stage. Once the operating point is established by the characteristics of the actual system, the pump will operate at constant head.

Dual Savings

By adopting butterfly valve control in a continuous piping system, money will be saved in first cost of pumps and outfall piping, and later in operating the pumps. Because this system has excess available head, outfall piping is designed for a friction loss not less than the available excess. The result is a smaller outfall line for which friction head is supplied by difference in elevation rather than by the circulating water pumps. In this case, the economic size for the discharge line to the condensers is 66 in., whereas the outfall line is only 42 in. to dissipate the available head.

Corresponding designs indicated that a seal well system would require from 25 to 40 per cent higher pump discharge head than the system adopted. The reasons for this can be seen from the fact that the seal well static overflow line must be at least high enough so the selected maximum vacuum of the condenser cannot be exceeded. In addition, the economic vacuum will be less than the maximum allowable to avoid draining the condenser, again requiring raising the design elevation of the seal well overflow.

Vacuum pumps will be provided to exhaust air and associated vapor from the condenser water boxes when the system is in operation. A vacuum tank is provided which enables these pumps to operate on automatic start-stop control and also avoids the possibility of damage due to water slugging over. Vacuum piping connections to the condenser water boxes are made through low-resistance automatic vent valves.

It was found that the economic value of siphon effect at the condensers is 24 ft of vacuum, referred to a 30-in. barometer. The economic study in this case was based on variation of first and operating cost of vacuum producing equipment as a function of condenser water box vacuum, compared to corresponding savings in first and operating cost of circulating pump.

Other considerations in designing the system included providing sufficient additional head at the circulating pump discharge to compensate for reasonable wear in service,

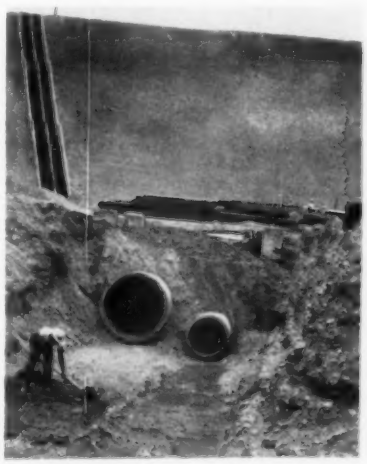


Fig. 3. Photo of 66″ inflow and 42″ outfall lines during construction dramatically shows the constriction in latter

and selection of a suitable pump characteristic so the system could be primed easily. To permit easy priming, the butterfly valve on the outfall will be installed below the water line. Manually controlled air vents are provided on the condenser water boxes.

Start-up Adjustments

Under this plan the butterfly valve will be closed manually and one or more of the circulating pumps will be started with the manual condenser vents open. Operating at a somewhat decreased capacity, the pumps will fill the system, venting the air in so doing. When water issues from the manual condenser vents, these will be closed and the vent connections will be opened to the vacuum system. The butterfly valve will then be opened until the vacuum gauge of the condenser water box approaches a reading corresponding to the 24-ft vacuum. The system will then be in operation.

Butterfly valve opening will be adjusted manually, using gauge readings as a guide. For safety, an interlock is provided in case all circulating pump motors are de-energized electrically. This interlock will close the butterfly valve fully to prevent draining the water side of the condenser. Each pump is provided with a butterfly valve which closes automatically when its pump motor is de-energized to prevent by-passing or siphoning of the pump leg of the siphon.

Butterfly control valve will be electric motor operated through a worm gear drive. If there is motor or drive shaft failure, the valve will remain in its last oriented position. All electric motor drives are also provided with hand wheels so local manual operation can be readily and conventionally accomplished when desirable.

Choice of butterfly valve control in this system represents a very significant saving in initial and operating costs over a corresponding seal well system. The system adopted is simple in design and uses conventional, proved equipment. Moreover, there is no sacrifice in safety because condenser siphonage is conceivable on the pumped leg of the siphon as well as on the outfall leg. THE END

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Readers wanting tear sheets of any article appearing in the issue may obtain them by indicating the items desired on one of the return post cards appearing in this issue. (Tear sheets are separate pages originally torn out of the issue, hence the name, but now supplied to us in limited quantities by the printer.)—Editors

Model Studies Save Money in Flue Gas Duct Design

WAYS IN WHICH scale models are being used to analyze flow of gases in ducts and the effect of this on design of ductwork and precipitators were demonstrated at an engineering conference held February 13 at the plant of Research-Cottrell, Inc, at Bound Brook, New Jersey. Reasons for these tests, the general procedure and some of the results are given below, but further technical details, illustrations and case studies will be given more fully in a subsequent article.

This model testing program was started several years ago by Research-Cottrell because they found that, in the design of their electrostatic precipitators, the design of ductwork conducting the gas to the precipitator affected the gas flow through the precipitator; and, that by improving this gas flow, money could be saved for industry. As it developed, the testing program became primarily a study of gas flow in ducts. Reason for such study is that the precipitator manufacturer is usually building his equipment on a "flange to flange" basis. He has no say in designing the ductwork leading to and from the precipitator, which may cause turbulent flow of gas into the precipitator. Result, a precipitator large enough to make up for the turbulent flow, hence often larger than necessary.

Savings for User

Flow of gas to and from the precipitator determines the gas pattern in the precipitator, hence influences the power required, the precipitator size and many other factors. Hence the model studies of gas flow by Research-Cottrell are intended to improve collector performance, conserve fan power, simplify flue shapes, cut dust buildups, increase precipitator design velocities, save engineering time.

In a number of specific installations, to be detailed in a subsequent article, various combinations of these factors have produced savings for the user. Research-Cottrell hopes they will lead to reductions of 10 to 20 per cent in precipitator size, and much saving of duct material and fan power. They state that, measured in terms of inches of water, the pressure drops through the gas system can be capitalized at from $40,000 to $80,000 for each inch.

Although not properly a part of the flue or duct design study, improvements in precipitator design have already been made. Studies of the costs of the models built to date indicate that a model costs from 1 per cent to 2 per cent of the cost of the precipitator.

Models used by Research-Cottrell are made of Plexiglas to 1/16 commercial size, or $\frac{3}{4}$ in. to 12 in. Most flow patterns are studied by use of smoke; but thread, ribbons, ground cork or dust are also used.

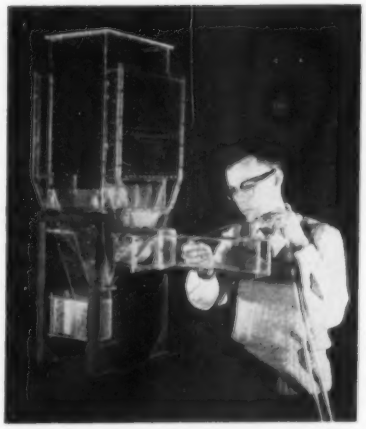


Fig. 1. Model built to determine best flue design for precipitator built in limited space between existing equipment

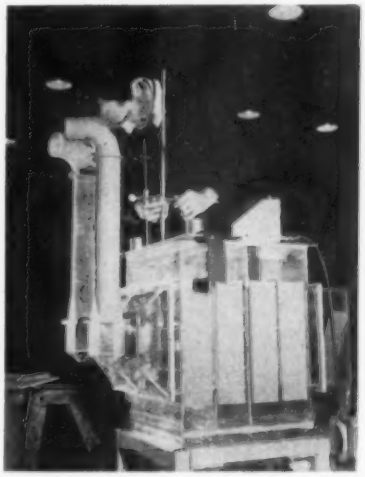
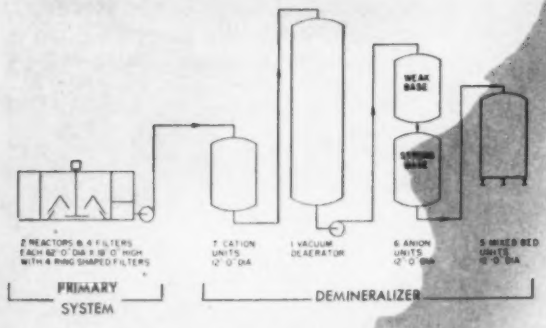


Fig. 2. Effect of variation in placement of perforated plates on gas flow through precipitator is determined by velocity traverse across plates of model

At the meeting where these models were displayed, an engineer from one of the private utility companies explained that already these tests have saved his company far more than their cost by modifying the design of ductwork for a new boiler.

One of the consulting engineers said that test work along this same line should be done with models of the entire power plant, both in the air and gas loop and in the steam loop as well.

LEADERSHIP IN WATER CONDITIONING


WEAK BASE
STRONG BASE
2 REACTORS & 4 FILTERS EACH 62'-0" DIA × 18'-0" HIGH WITH 4 RING SHAPED FILTERS
7 CATION UNITS 12'-0" DIA
1 VACUUM DEAERATOR
6 ANION UNITS 12'-0" DIA
5 MIXED BED UNITS 10'-0" DIA
PRIMARY SYSTEM
DEMINERALIZER

FLOW DIAGRAM — 4 BED SYSTEM WITH MIXED BED POLISHING SECONDARY UNITS — Q = 2200 GPM

LINDEN

Cochrane DEMINERALIZER

protects high pressure boilers and turbines at Linden Generating Station

WATER ANALYSIS In Parts Per Million

	Raw Water	Final Effluent	
Turbidity	3-46	0 to 0.5	Primary Treatment
Color	40-160	0 to 2	
Total Hardness as $CaCO_3$	26-164	0	Demineralizer
Alkalinity as $CaCO_3$	66-183	0 to 0.1	
Silica as SiO_2	3-12	0 to 0.01	
Dissolved Oxygen as O_2	Saturated	0 to 0.1	
Total Dissolved Solids	100-520	0 to 0.2	

TREATING PLANT

- 2—Solids-Contact Reactors, 62' dia. x 18' high, with four peripheral gravity anthracite filters. — Primary Treatment
- 7—Cation Units, 12' dia.
- 1—14' Vacuum Deaerator, rubber-lined.
- 6—Weak Base Anion Units, 12' dia.
- 6—Strong Base Anion Units, 12' dia.
- 5—Mixed-bed Polishing Units, 10' dia. — Demineralizer

Public Service Electric and Gas Company's new Linden Generating Station features the most outstanding Demineralizer Plant ever installed. The system, designed and manufactured by Cochrane, treats 30 to 100% make-up for boilers with design pressures up to 2700 psig.

Some of the unique features include complete automatic remote control for both primary treatment and Demineralizer Plant . . . Filter and demineralizer backwash recovery for re-use . . . Re-use of most anion rinse water . . . Low acid consumption . . . Silica reduction in two stages: first, by strong base primary anion units, then by mixed bed secondary units . . . Low caustic soda requirements . . . Resins cleaned by brine automatically. These and many other features assure the ultimate in efficiency for this plant.

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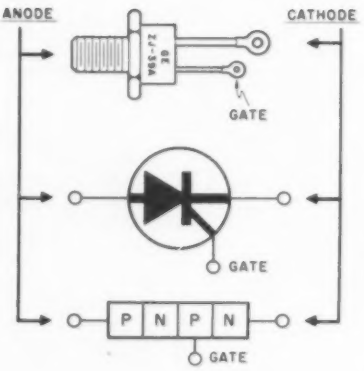
Like transistors, semiconductor rectifiers are small, have virtually unlimited life and achieve very high efficiency ratings in circuits. G-E's controlled rectifier constitutes a new type of device that combines the features of a conventional semiconductor and a high speed power switch

How the Controlled Rectifier Works

by ROBERT FRENZEL*



Silicon controlled rectifier combines features of both a transistor and a rectifier. It is a PNPN semiconductor consisting of three rectifying junctions. After "turn-on", voltage across the device is very low, and current is determined by load which it is feeding

WHAT our engineers have done is to build some prototype samples of a semiconductor device using silicon, which will perform the same function as the gas thyratron.

Some of you may never have heard of a gas thyratron or what it can do and therefore may have little notion of what a semiconductor thyratron or controlled rectifier means.

Well, as you know, a simple 2-electrode rectifier changes alternating current to direct current. Basically, with one rectifier, you can get one-half of the alternating current into the circuit, put out in the form of direct current. But you cannot practically vary the amount of direct current coming out. This is set once and for all by the circuit design.

There are several expensive mechanical and electrical means for varying the amount of work done by this direct current output. Among them are gear systems, step-down transformers, rotating amplifiers, and voltage varying devices. Gas thyratrons can do the job electronically and eliminate the complicated and expensive other methods, but thyratrons are too big and too temperature-limited for many applications. Also, they have the same life limitations as other electron tubes.

The controlled rectifier, or semiconductor thyratron, on the other hand, is small—about 1/100 the size of equivalent gas thyratrons — and like other semiconductors has a virtually unlimited life. Where thyratrons are temperature-limited to 90 C (194 F) the controlled rectifier will perform at 150 C (302 F) and possibly even higher than that.

The new G-E silicon controlled rectifier (see figure) is a PNPN semiconductor consisting of three rectifying junctions. (Silicon is called N-type when it has too many electrons, P-type when it has too few. Where P and N layers join, a barrier is set up which resists electric current flowing in one direction, passes it easily the other way. A controlled rectifier has four areas, arranged PNPN.)

The device will block current flow through it in either direction until it is "turned on" by applying an appropriate signal to a third lead (called the "gate") which consists of an ohmic contact to the center P region. After "turn-on," which occurs at speeds approaching a microsecond, the voltage across the device is very low (similar to a conventional silicon rectifier) and the current through it is essentially determined by the load it is feeding.

This feature enables the user to control a large anode to cathode current through the controlled rectifier with an extremely small amount of power applied at the gate electrode, or to switch power from a high impedance to a low impedance in microseconds.

In switching on the controlled rectifier by a signal applied to the gate, a certain minimum d-c gate current is required. If a current pulse is applied to the gate, the required pulse amplitude will decrease as the pulse width increases. As the pulse width is increased, the required pulse amplitude will approach the d-c gate current as a limit.

Probably the biggest use of these new controlled rectifiers at first will be in industrial machinery and military equipment. They will undoubtedly find wide use in replacing latching-type relays in circuits for switching power. They will turn on in one and one-half millionth of a second, and off at a slightly lower rate, and can be used to vary the amount of power needed to control the speed of motors or to control the intensity of lights in a theater.

Controlled rectifiers we have seen so far can switch and control a load of 300 v and 5 amp or 1.5 kw of power with only 15 milliwatts injection at the control lead. This is a control ratio of 100,000 to 1.

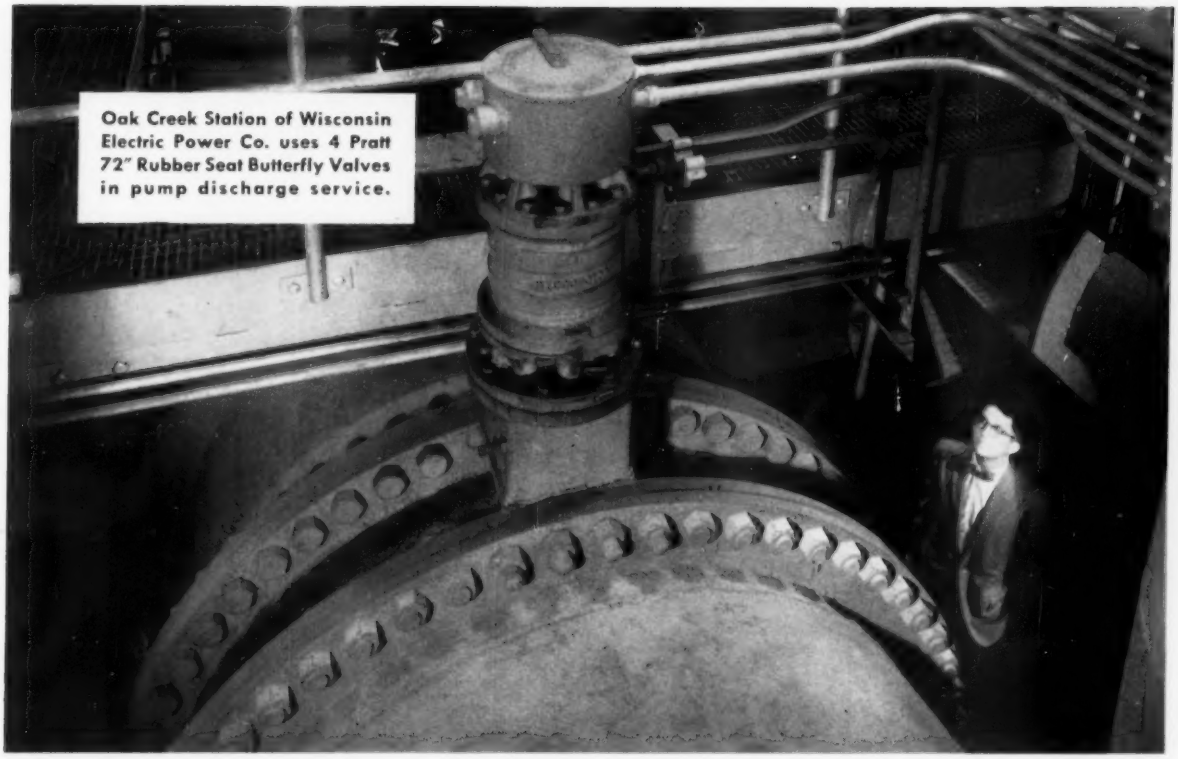
Other potential applications for the silicon controlled rectifier would of course include automatic machinery (automation controls), where the speed of motors is controlled by computers, punch cards or magnetic tape.

In commercial welders, the silicon controlled rectifiers can be used to control the amount and rise and fall of current flow, which in turn controls the quality and uniformity of the weld. Eventually they may be used in kitchen food mixers, electric equipment and lighting controls.

Actually, the new G-E controlled rectifier is a starting point for whole families of new applications besides the time-tested ones in which thyratrons, mercury-arc tubes, and magnetic amplifiers are now being used. In designing circuits for the device, the engineer needs to keep in mind several factors:

1. As in other semiconductor devices, rated PIV and specified load currents should not be exceeded.
2. The device does not include its own heat sink, and should be cooled by mounting the stud on a fin.
3. Peak gate current should not be allowed to exceed 300 milliamp. Also, reverse gate current (out of the gate terminal) should be limited by a diode in series with the gate lead if reverse voltages exist in the gate circuit.
4. Because of the temperature sensitivity of the control characteristic, it is desirable to fire the device with a steep wavefront of gate current wherever possible. Saturable reactor and pulse types of control are particularly suited for this. THE END

*Product Planner, Semiconductor Products Dept, General Electric Company



Oak Creek Station of Wisconsin Electric Power Co. uses 4 Pratt 72" Rubber Seat Butterfly Valves in pump discharge service.

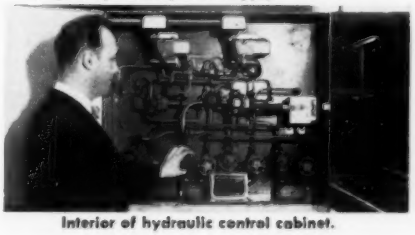
MILWAUKEE...Pratt Butterfly Valves offer "two valves in one" for pump discharge

Pratt Rubber Seat Butterfly Valves in pump discharge service can be made to open and close in synchronization with pump operation, AND they close drop tight—combining, in a single valve, the functions normally achieved by separate shutoff and check valves. The simple combination of disc, shaft and efficient closure provides years of dependable performance without maintenance problems.

Pump discharge valves at Oak Creek Power Plant are hydraulically operated with oil motors. The electro-hydraulic system includes a bank of accumulators and complete auxiliary manual controls to permit operation under any emergency condition.

Pratt pioneered the use of rubber seat butterfly valves in power plants, and today offers the greatest aggregate experience on butterfly valving in the power field. For valve design—**with imagination**—see Henry Pratt.

Felix Kazmerchak, Ass't. Plant Engineer, and Ray F. Egebrecht, Pratt Representative, inspect hydraulic power supply.



Interior of hydraulic control cabinet.

Have you sent for your copy?...of Pratt's 40 page **Manual of Rubber Seat Butterfly Valves.** Useful—contains latest pressure drop and flow data, conversion tables, butterfly valve theory and application. CATALOG B-2.

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Power Engineering handbook

New Ways to Splice Cable

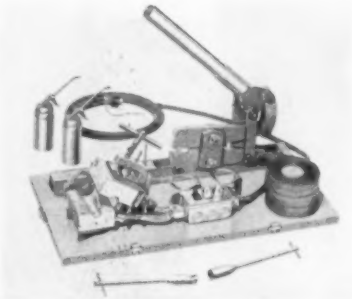

Fig. 1. Cam-Lok kit includes crimping press, cable cutter, vulcanizing mold, is used anywhere

TWO NEW systems for splicing cable have made their appearance, one from Minnesota Mining and Mfg Co, the other from Cam-Lok Division of Empire Products, Inc.

The Cam-Lok 110-v cable-splicing kit makes splices which are flexible, waterproof and shockproof. Cable insulation is stripped back. Bare ends of cables are then inserted in a copper tube supplied in the kit (Fig. 1), and are crimped with the high pressure crimping press in kit.

An inner sleeve is placed over the crimp to eliminate voids and to keep the splice flexible. An outer sleeve is then vulcanized to the cable jackets to prevent moisture from entering and damaging cable, and also to keep cable jackets from pulling away from the splice. The method permits splicing of sections as short as 2 ft. Finished insulation of the splice will withstand 2500 v without leakage, the manufacturer claims.

Minnesota Mining and Mfg Co's system is called the "Scotchcast" resin pressure splice and can be used on lead, rubber and plastic sheathed cable or combinations, as well as shielded cable.

The method uses an open mesh screen-like tape as a spacer material, wrapped around the splice. The build-up of open screening is covered with a liquid-impervious plastic tape holding an injection fitting to allow entry of the resin into the splice. The plastic tape in turn is covered with low stretch tape to restrict the expansion of the plastic envelope when resin is forced into the splice. The steps are outlined in Figs. 2 to 8.

Fig. 2. Scotchcast splicing system wraps prepared cable with grid-like spacer tape, then applies aluminum foil tape to carry shielding over splice

fold along this line—outside edges toward you

Fig. 3. Foil tape is ironed down and the shielding is completed by soldering jumper wires across the splice from the original cable shielding

Fig. 4. Shielding completed, new layer of spacer tape is applied for desired thickness. Then vinyl tape wrap is begun and injection fitting placed

Fig. 5. A supporting wrap of fabric tape provides mechanical support for the stretchy vinyl against resin, with injection fitting positioned under it

Fig. 6. After splice is wrapped, resin and resin gun are prepared to "shoot" the splice. Unipak container holds both the epoxy resin and the catalyst

Fig. 7. With gun assembled and envelope punctured, nozzle is inserted into injection fitting and trigger squeezed, forcing resin into splice

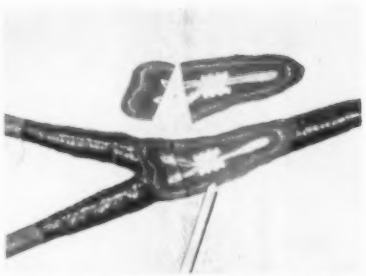

Fig. 8. Cutaway shows how splice is completely saturated with resin. Shielding tape, jumper wires, connector and conductor strands are imbedded

cut along this line

Vogt

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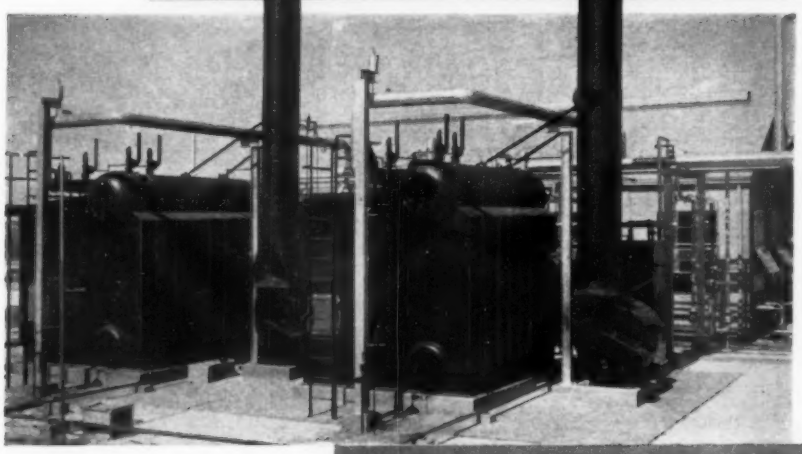
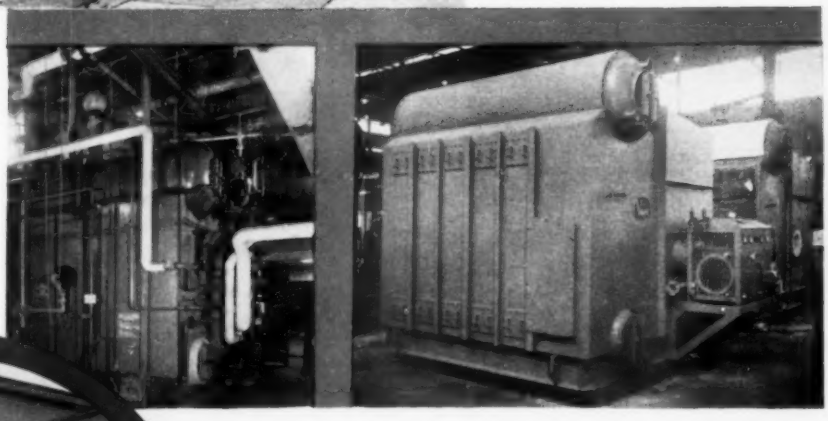
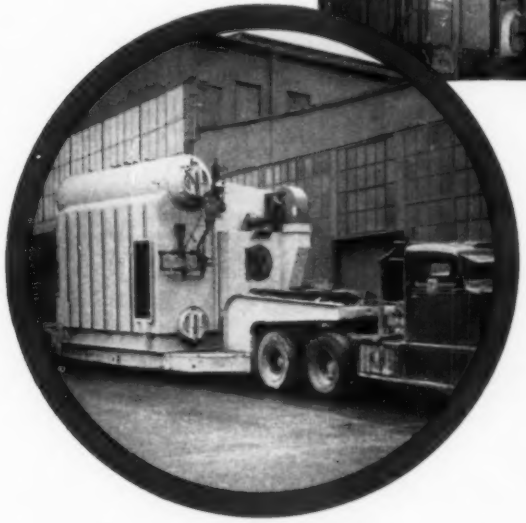




Above: Two units serve a gas pipeline company.

Left: Installation in fibre box-board plant.

Right: Unit for a leading soap manufacturer.



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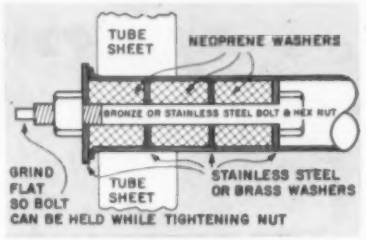
Got a Leaking Condenser Tube? Try This Cure

By ED RIGBY

PROCEDURES for repairing leaking condenser tubes run all the way from simple wooden plugs to full-length tie rods. Here's one that I have used successfully and which will remain in place for a long life.

Sketch explains the procedure. Chance of the plug being drawn into the tube is eliminated, nor will any reasonable back pressure force it out, because of the friction of the neoprene washers as they are compressed against the tube wall.


TUBE SHEET
NEOPRENE WASHERS
BRONZE OR STAINLESS STEEL BOLT & HEX NUT
GRIND FLAT SO BOLT CAN BE HELD WHILE TIGHTENING NUT
TUBE SHEET
STAINLESS STEEL OR BRASS WASHERS

Plugs can be reused when tubes are renewed

Ways of Handling Coal in Freezing Weather

TIPS FROM BITUMINOUS COAL INSTITUTE

UNLOADING rail-delivered coal during the winter months presents no serious difficulty if the problem is studied and the solution provided before the coal is received. Two basic solutions are available: buying treated coal or a coarser size of coal than is normally used; and/or providing a means of thawing frozen coal at the consumer plant.

Coal Treatment

Double-screened and/or heat-treated washed coal above 3/8-in. bottom size generally does not freeze because water runs off freely from coal free of fines. Screenings and slacks containing fines retain surface water and should therefore be treated to prevent freezing. Treatment consists of spraying the coal during loading at the mine with either oil or water-soluble salts.

Oils and oily substances make coal surfaces resistant to wetting and mechanically deter cementing of the coal particles through freezing. Oil treatment of stoker coal and nut-slack grades requires spraying with 3 to 12 gal of oil per ton. This will prevent freezing except in extremely cold weather. Further, the oil adds a thin coating to the cars and the coal-handling and storage equipment.

Water-soluble salts reduce the freezing temperature of water. Any given concentration of salts lowers the freezing point a set amount; hence, coal may be conditioned to meet any anticipated degree of freezing weather. Between 200 and 300 lb of salt is generally used per ton of coal. The treatment may be partially nullified, however, by dilution of the salt with rain or snow, or the salt may be drained off with the initial water. Low-cost salts most commonly used for freezeproofing are commercial calcium chloride or rock salt. These salts generally have some corrosive effect on coal-handling and storage equipment, so the method should be used with care. The use of inhibitors in the salts greatly reduces the corrosive action.

Some shippers treat the coal over the coal hoppers very heavily to ensure that unloading will at least start; the remainder of the coal may then be more readily broken out. The freezeproofing treatment is helpful.

Unloading Frozen Coal

A number of devices, some of them comparatively new, will prove helpful in unloading frozen coal from railroad cars.

The thawing pit is a relatively inexpensive yet effective aid. As properly constructed, it employs indirect radiant heating to thaw the coal, thus minimizing damage to the cars during the operation. One or more pits may be installed, depending on the number and types of cars requiring simultaneous treatment. The pit consists essentially of a shallow, well-drained combustion chamber installed between the tracks; the flames from two oil or gas burners impinge on the side walls of the pit, heating its refractory linings to irradiancy. The heat radiated from the walls rises up and through the car hoppers, and thawing is accomplished without direct flame contact.

Pits may be equipped with either high- or low-pressure oil or gas burners, according to local conditions. Housing structures are not required; thus, there is no restriction on normal traffic over the tracks. In some cases, a wall made of corrugated steel or aluminum or a transite siding, extending to car height, is used as a windbreaker. Such pits are frequently used in conjunction with a car shaker to improve unloading efficiency.

Fuel consumption and thawing time are subject to considerable variation depending on the type and size of coal, its moisture content, the degree of freezing, and the weather. A fair range of probable oil consumption is 8 to 15 gal per 50-ton car. Thawing time ranges from 20 min to 1½ hr under average conditions. Prefabricated thawing pits with oil- or gas-burning equipment are available, cost about $1400.

Thawing sheds, completely enclosed and heated by either live or exhaust steam, are sometimes provided. Corrugated-steel or asbestos siding is used. The shed must be constructed wide enough to provide clearance at the car sides, and with sufficient headroom to allow a man to stand on top of the car. This type of installation is generally costly, and thawing time is rather lengthy.

Portable car thawers can adequately serve some smaller industrial plants. These units, burning light fuel oil or kerosene, are available for use with either compressed air or a hand-operated air pump. Unit cost is only about $300 to $350.

Most industrial plants will find it useful to install a simple car shaker which, used in conjunction with a portable car thawer, will relieve most of the difficulties encountered at such plants. Car shakers of this type vary in cost from $2000 to $2500 installed.

New thawing devices on the market are claimed to provide fast unloading at low cost. One manufacturer supplies oil-fired, perforated alloy radiant tubes that are laid between and alongside the tracks. Under some conditions, such an installation handles 14 cars an hour at a cost of $2.30 per car, including oil and labor. Corrugated aluminum-panel windbreakers are provided on either side of the tracks; an expensive, completely enclosed thawing shed is not necessary. The cost of this installation for a two-hopper car is $2000 to $2500.

Another device on the market is a gas-heated ceramic mat that provides infrared radiation at approximately 1650 F. The mat is made up of eight ceramic catalysts, each perforated with 200 holes per sq in. This combination is called a ray head. Gas is metered through an orifice, passes through an air-aspirating chamber to a mixing tube, and then to a chamber under the ceramic mat. The ray heads, each designed to radiate vertically or at an angle, are placed alongside and at the bottom of the car to thaw the frozen coal on the end sloped sheets. It is claimed that cars can be dumped after 30 to 35 min of heating with this equipment.

Unloading Delays

If delays in unloading cars during the winter months are experienced, extra unloading time, free of demurrage penalties, may be obtained from the railroads. The appropriate railroad agent should be notified, certifying the day or days during which time was expended in heating, thawing or loosening the lading of a car. Notice must be given prior to the expiration of 10 days (excluding Saturdays, Sundays and holidays) after the car is released. When proper notice is given to the railroad, "each day so certified but not exceeding a maximum of two days will be allowed in addition to the usual free time."

For names of manufacturers of the various devices mentioned above, write The Editor of POWER ENGINEERING.

POWER ENGINEERING HANDBOOK

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6. Corrosion
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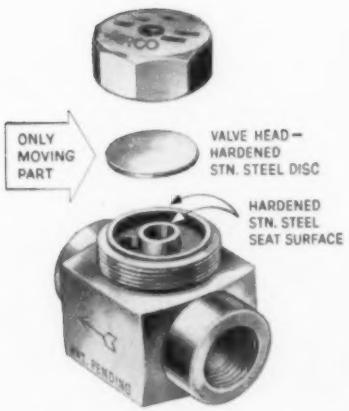

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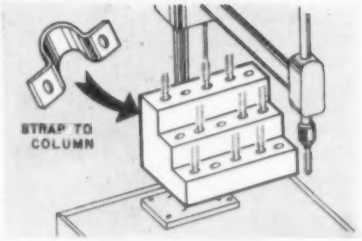


Fig. 1. Holder attached to post keeps drills handy

Fine Points in Drill Use and Care

By CHARLES H. WILLEY

STEPPED DRILL or tap holder shown in Fig. 1 is a good way to keep the most commonly used sizes conveniently at hand for quick changes. It can easily be made from a hardwood block, and attached to the drill or tapper post. Another advantage — taps are kept sharp, since there's no dulling of edges which occurs when tools are stored together in a drawer or other container.

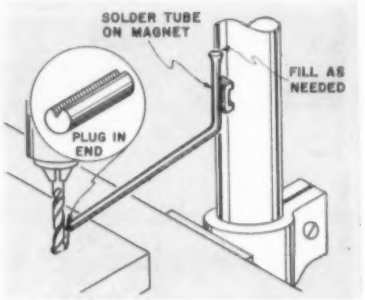


Fig. 3. Feeder can be used for oil tube if desired

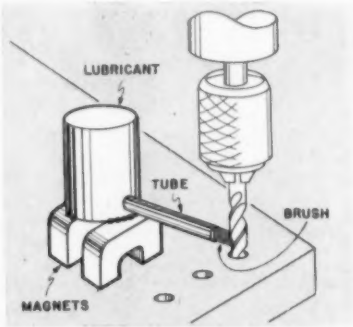


Fig. 2. Simple way to provide steady lubrication

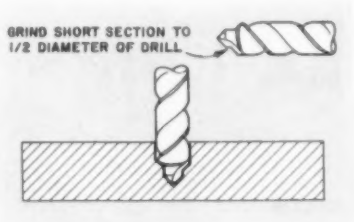


Fig. 4. Pilot tip ground on drill acts like two drills

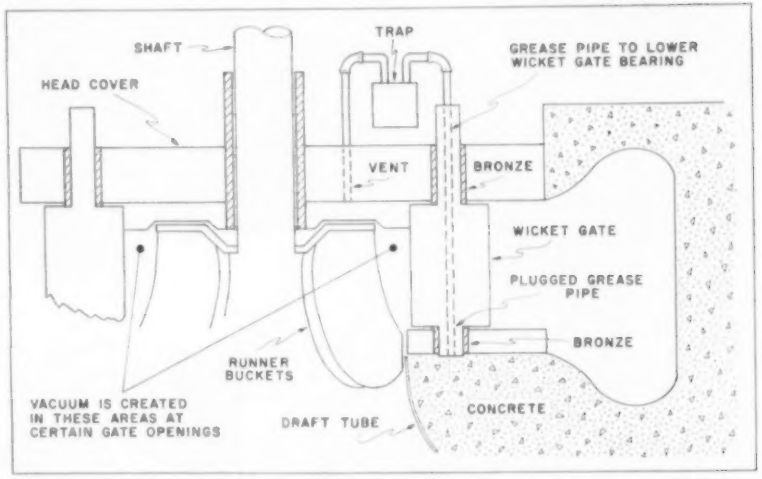
Figures 2 and 3 show ingenious ways to supply the steady lubrication needed to insure long life for drills. Device in Fig. 2 is made from a couple of Alnico magnets soldered to a can, and a short piece of copper tubing. Brush is made by flattening a few bristles from a nylon brush into the end of the tube.

The column attachment in Fig. 3 is made by soldering the tube to a magnet, with one end flared to receive the oil. The other end has a small dropper plug inserted. One filling of the tube is generally enough for drilling one hole.

When you have to drill large-sized holes, clear through, with a hand drill, either brace or electric, the work will go much faster if you use the idea shown in Fig. 4. Grind the drill to form a pilot drill, as shown in the sketch. This will also prevent drill breakage. You may say, why not drill a small hole first and then follow with a large hole? That's a good method, too; but the pilot drill is more accurate, easier, and not subject to breakage.

When using small, fine drills, put them in a small pin vise to be sure they run true. Pin vise is inserted in the regular drill chuck. This way, you get a sure grip, and the drill is not liable to run-out or breakage.

fold along this line—outside edges toward you



Hook-up by which vane stems on a water turbine were successfully unblocked. Vanes were filled with Permag

Unblock Hydro Unit Vane Stems By Unique Method

By LLOYD McWILLIAMS

WHEN THE lower vane stems on a water turbine became blocked with foreign matter, or by soap which had separated from the grease, all attempts to clear the blockage by employing high pressure were unsuccessful. Pressures of over 5000 lb failed to clear the vanes; various solvents were tried. The vanes remained blocked.

Then someone suggested "sucking" the vanes clear. No vacuum pump was available. This same old Joe further suggested that, since there is 19 to 20 in. of vacuum available at certain gate openings, we might be able to clear the vanes by this means. (Many turbines are supplied with vents for the express purpose of breaking this vacuum when running machines as condensers.)

The accompanying sketch shows the hook-up by which the vanes were successfully unblocked. First, the vanes were filled with a powerful solvent (Permag) and this was allowed to work for 24 hours. Upon applying the vacuum, drill cuttings and other foreign material, which had been in the vanes since installation, were drawn from the blocked grease pipes and openings. It is now possible to grease the stems at a greatly reduced pressure.

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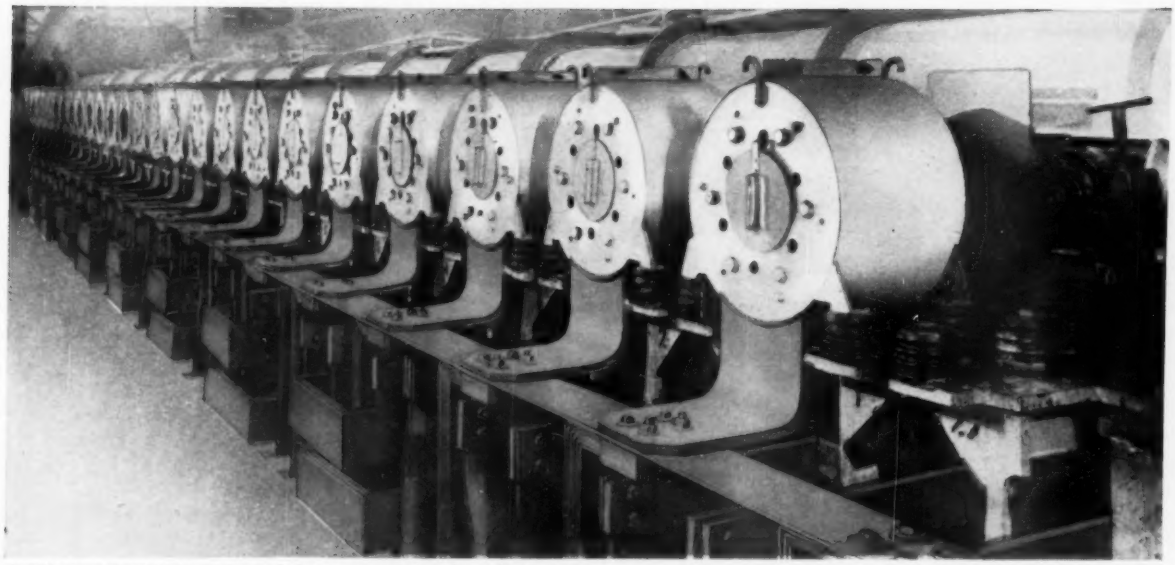

THROUGH THE TINNING LINE, steel sheet up to 38" wide and .0125" gage passes at 1000 feet per minute. A total plating current of about 178,000 amps is carried to the 27 collector heads from the bus room below by these rectangular bus conductors. Installation involves about 115,000 lb. of copper bus conductors.

Big new sheet tinning line drawing 178,000 amperes is served by this compact Copper Bus installation

Copper bus conductors were selected for this installation in a plant of one of America's great steel companies because it made possible a saving of 20 per cent in space.

D. Anderson Murphy, president of Riggs Distler & Co., mechanical and electrical contractors, Baltimore, Md., which made the installation, states that one of the big reasons for the selection of Anaconda bus was the outstanding engineering and technical service available through The American Brass Company. Anaconda engineers worked closely with Riggs Distler to help solve many of the problems posed by this complex job. Mr. Murphy adds that the bus conductors came through well packaged, with clean ends indicating a good sawing job, and came through promptly on schedule—other factors in the selection of Anaconda conductors.

TECHNICAL SERVICES. Anaconda specialists are available to help solve technical problems involving the use of Anaconda Bus Conductors. For such assistance or a copy of the 62-page Publication C-25, "Anaconda Copper for Electrical Conductors," write: The American Brass Company, Waterbury 20, Conn.

A VIEW IN THE BUS CONDUCTOR ROOM, showing ventilated square tubes and flat bars. Sizes of tubes used were 6" and 4" square by $\frac{1}{2}$" and $\frac{5}{16}$" by up to 22' 1" long. Rectangular busses used 6" and 4" x $\frac{1}{4}$" in lengths up to 20'.

57102

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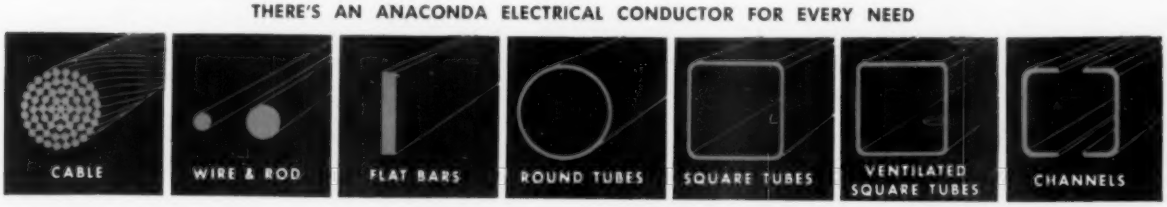
COPPER CONDUCTORS

Made by the American Brass Company

THERE'S AN ANACONDA ELECTRICAL CONDUCTOR FOR EVERY NEED



For more data circle 542 on Post Card

How To Get Universal Movement on Milling Machine

By WILLIAM A. SHEFFER, Jr.

OFTEN it is desirable to obtain a universal movement on a plain milling machine. This can be done by mounting a standard lathe milling attachment on the milling machine table, which is ample in scope for small work. With this set-up, the miller may also be used as a drill press, drilling holes at compound angles more easily and accurately than can be done in a drill press.

Should the attachment bring the work too close for use with the longer end mills, an adapter plate can be made up, and the attachment set farther out.

The vise on the attachment will also fit the attachment base, allowing more cuts to be made without removing work from the vise.

We also find that the attachment is of special value where cuts must be made across the face of the work, as there is no obstruction to the travel of the cutter or to the vision of the machinist.

With this set-up, miller may be used as drill press

Be Sure to Ventilate Dipping and Plating

EVERYONE should be aware of the importance of proper ventilation in the area of dipping and plating operations. As Clayton T. Lang of Westinghouse points out in the National Safety Council's newsletter, inhalation and skin contacts are not the only hazards. Inadequate ventilation can also affect certain equipment to create other hazards.

Safe and satisfactory operations of electroplating metallic rectifiers depend on good ventilation. A ventilating fan is part of the apparatus and cools the transformer and rectifier plates. If the air is contaminated, the impurities are carried into the various components of the rectifier. Even dirt and lint would eventually clog the small gap between the plates, if not controlled.

Worse than this is the admission of an acid-laden atmosphere This, over a period of time, breaks down the resistance of insulating material, creating a hazard, and permits the acid deposit to bridge live contact, causing shorts. Acid fumes can also cause serious damage to the equipment. It can corrode the bus bar connections to the rectifier plates to the extent that they break off, thus cutting output and reducing the rectifier rating as much as 50 per cent in some cases.

Periodic checks of the rectox plate units should be made to see that the gap between the blades is not clogged with dirt. Where there is an indication of this, the blades can be blown out with compressed air. Electricians testing circuits should be aware of the maximum voltage existing in the equipment.

The best precaution is keeping the rectifier free from acid fumes. The use of a good ventilating system will bring in fresh and clean air to the rectifier. This will prevent damage to important equipment and even more important, prevent serious injuries to the employees who must keep equipment working.

fold along this line—outside edges toward you

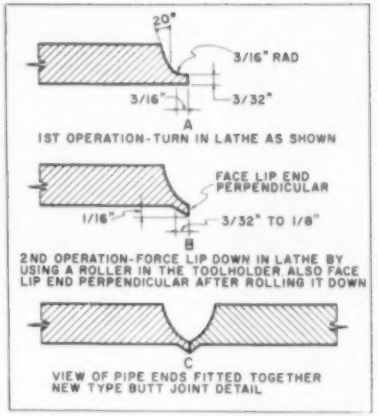

20°
3/16" RAD
3/16"
3/32"
A
1ST OPERATION-TURN IN LATHE AS SHOWN
FACE LIP END PERPENDICULAR
1/16"
3/32" TO 1/8"
B
2ND OPERATION-FORCE LIP DOWN IN LATHE BY USING A ROLLER IN THE TOOLHOLDER ALSO FACE LIP END PERPENDICULAR AFTER ROLLING IT DOWN
C
VIEW OF PIPE ENDS FITTED TOGETHER NEW TYPE BUTT JOINT DETAIL

Fig. 1. Steps in the process of preparing root edges of joint for welding pressure piping

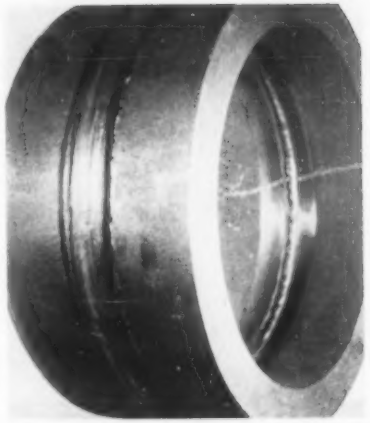


Fig. 2. Finished weld showing smooth submerged arc welding beads and uniform condition of inside

Welding Technique For Pressure Piping

AN ARC-WELDING process which eliminates the need of metallic backing rings or inserts when welding butt joints in pressure piping systems is being successfully applied by Stone & Webster.

In power, chemical, petroleum, nuclear installations and in other applications where it is necessary to produce a uniform inside bead condition, this inert-gas-shielded welding procedure is used by the Boston firm on construction jobs in all parts of the world.

Major feature of the technique, developed by R. T. Pursell, is the novel manner of preparing the root edges of the joint. Root edges are bent to produce an internal circumferential lip. When edges of this type are fused together in an inert gas atmosphere, the inevitable concave condition associated with fixed position yield welds is eliminated.

Another innovation of the process is the method of burning up the paper dams with an oxy-acetylene flame or stress relieving coils.

Simple Way to Make Boiler Gages Easy to See

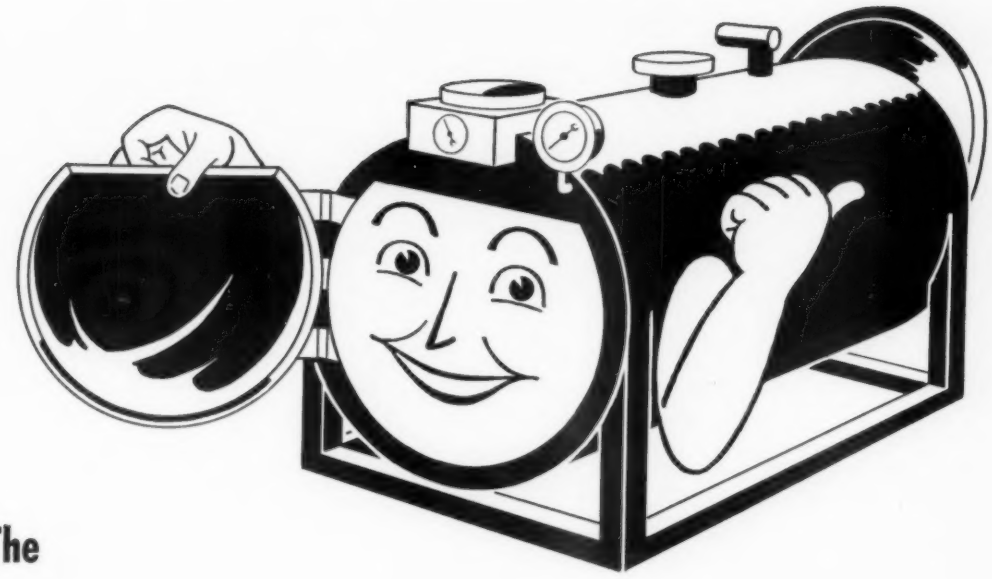
By H. MULLER

TO MAKE it easier for our men to see the correct water level in our boiler gages (sometimes difficult even under good lighting conditions), we stick a piece of $\frac{1}{4}$-in. red cellophane tape on the back of the glass tube.

What happens is that above the water level, the tape appears to be narrower than it actually is; but below the water level it is magnified so that the tube seems filled with red liquid, making it easily read.

The tape is applied to the tube vertically for its full length.

cut along this line



The Boiler that doesn't show its age

The practical, two-pass design of the Continental Automatic Boiler is a long-life feature that cuts operation and maintenance cost. The hinged doors – front and back – open on the burner. No baffles or partitions that can be damaged in routine servicing. No take-out, put-back refractories.

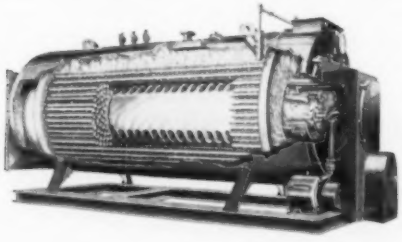
Continental's exclusive "spinning gas" technique heats all return tubes fully and evenly in just two passes, assuring longer service life. Free, rapid water circulation improves heat transfer and keeps heating surfaces clean.

Low maintenance is just one of the cost-saving features of the Continental Automatic Boiler. Every Continental is fire-tested and guaranteed for better than 80% efficiency. Owners report fuel savings up to 33% . . . and Continental efficiency stays constant over a wide load range and a long service life.

Continental Boiler Service, available from coast to coast, includes aid and supervision in start-up, operating instruction for attendants, competent and dependable service when needed. See your service-minded Continental Boiler representative or write for Bulletin BE-3.

BOILER ENGINEERING & SUPPLY COMPANY, INC.
3 Manavon Street, Phoenixville, Pa.

The Continental AUTOMATIC BOILER



Cut-away view of typical Series A Continental Automatic Boiler, firing oil and/or gas. Other models from 20 to 500 hp, with on-off, low-high-low or modulating controls. For steam heating or process work at pressures from 15 to 250 pounds, or for hot water heating at low or high temperatures.

A HALF CENTURY OF BOILER MANUFACTURING EXPERIENCE

For more data circle 543 on Post Card

EQUIPMENT NEWS

Described on these pages are new and improved products. Use Reader Service Cards on pages 105–106 to ask for more information on them. Just circle the item numbers of all the products in which you are interested.

1—SAMPLING CONDENSER for superheated steam of 1100 F

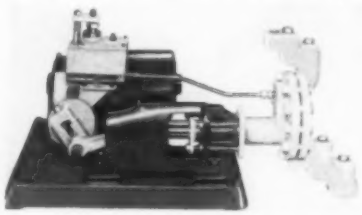
Analysis of the mineral content of superheated steam is reported possible with the Excello Steam Sample Condenser. The shell and tubular coil type heat exchanger condenses 1 lb of steam per minute up to 3500 psi pressure and temperatures as high as 1100 F. The condensate is analyzed to determine the mineral content of steam in electric generating stations operating at high pressures and temperatures. Condensate is cooled from its superheated steam state at 1100 F to water at 80 F. About 2¼ sq ft of cooling surface is compacted into the 11 in.-by-3⅞ in. diam condenser by the use of 25 ft of ⅜-in. OD by 20-gage stainless steel tubing. Five gallons of cooling water per minute at 70 F inlet temperature are needed to produce this amount of condensate. Technical Engineered Products, Inc.

2—DIELECTRIC TEST SET handles d-c measurement to 100 kv

Model 2 Dielectric Test Set is designed for measuring direct current at voltages up to 100 kv when applied to the insulation of electrical equipment such as generators, transformers, bushings, cable. Features reported for the Model 2 include: provisions for utmost safety; simple operation and reliable performance; excellent output voltage regulation; compact design; facilities for voltage and leakage current measurements. Incorporated in the Model 2 is a polarized primary which serves to prevent the set from being raised above ground potential. Also included is a high voltage reset button to prevent high voltage output being energized without operator's knowledge. James G. Biddle Co.

3—METERING PUMPS for toxic, corrosive, costly chemicals

Retaining the Step-Valve liquid end and other features of company's standard line with which it is interchangeable, these controlled volume diaphragm pumps have Teflon diaphragms sealing the liquid ends from plunger and housing. Claimed accurate to within ± 1 per



cent, they are positive displacement pumps. The plunger displaces hydraulic fluid which, in turn, strokes the diaphragm to impart pumping action through double ball checks. There is no mechanical connection between diaphragm and plunger. Available with maximum capacities from 1.1 to 138 gph and pressures to 2000 psi, the pumps have manual or automatic capacity adjustments from 0 to 100 per cent. Milton Roy Co.

4—BIG DUST COLLECTOR improves operations, cuts costs

Using 24-in. diam tubes, this larger Cyclo-trell Dust Collector is designed to apply basic Cyclo-trell advantages to the collecting of abrasive, hygroscopic and high moisture content materials. This larger collector could also provide a more economical installation than smaller units in certain applications where collection efficiencies below 85 per cent satisfy requirements, it is pointed out. Operating economies are also reported possible with this collector where 85 to 90 per cent of the particle size of the material handled is coarser than 10 microns, even when the operation requires collection efficiencies as high as 95 per cent.

The new 24-in. Cyclo-trell has 14 inlet vanes, as compared with seven in the smaller 10-in. model. Both are centrifugal multiple tube units employing same design features to provide greater separating forces and smaller pressure drop. One design feature is the aerodynamically shaped inlet vanes of the outlet tube which minimizes gas turbulence around vanes and develops higher centrifugal forces. Research-Cottrell, Inc.

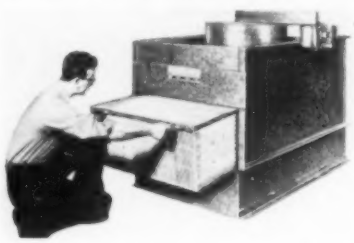
5 — MEMORY METER retains readings taken any time

This "memory meter" is designed to retain indefinitely a reading taken at any desired instant. It is described as a simple, reliable means of achieving results formerly requiring fairly complicated equipment. The instrument is declared especially suitable for applications where readings at a given time must be known but cannot be noted immediately — as in remotely-located meters. According to manufacturer, readings may be taken at any point on the meter scale, and not necessarily at the maximum reached by the signal.

The new unit is essentially a sensitive panel meter with a rear-mounted solenoid that is normally energized so that its plunger is retracted. When a reading is desired, the solenoid is de-energized. Its nylon-headed plunger pushes against the back of the face plate, normally held away from the pointer by two small springs at its base. The pointer is held fast at the reading instant between face plate and a clamper plate mounted over the top arc of the face plate. If desired, operation of the solenoid can be reversed so that the coil is normally de-energized. The memory meter comes in sensitivity ranges from a few microamperes or millivolts to 50 amp or 500v, d-c or a-c. Assembly Products, Inc.

6—COOLING TOWER is low, general purpose type

This low silhouette general purpose cooling tower, with 15- to 200-gpm capacity, measures 44 to 84 in. high, depending on capacity. Its compactness is attributed to use of multi-finned internal decking constructed of non-corrosive plastic, the notched plastic sheets providing greatly increased water-to-air exposure. No nozzles are required to



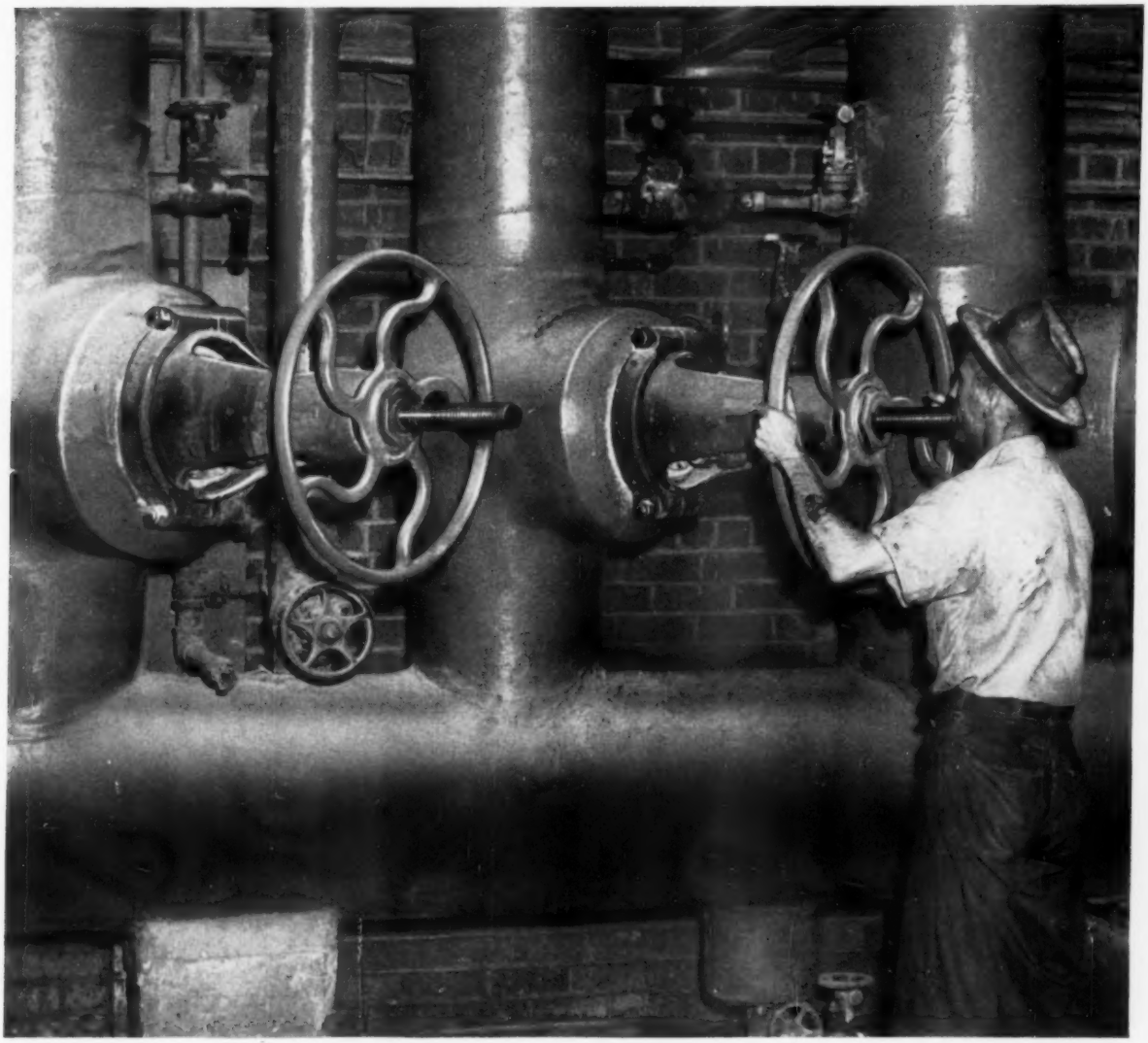
effect initial water break-up. Water enters at the tower top under a low head of pressure. Gravitational flow carries it down over multiple plastic decks mounted in two removable drawer-like receptacles at each end of the tower. These internal decking units simplify cleaning and inspections, and since metal parts of the tower are hot-dip galvanized after assembly no other surface protection is needed.

Above and between the two decking units is a dynamic and static balanced fan, which draws air up through the decking. The weatherproof motor of the belt-driven propeller fan is mounted outside the air stream. All frame sizes are rectangular. Binks Mfg. Co.

7—CONTROL LOCK is shear-action locking device

This automatic irreversible control is designed to hold control settings and eliminate the backlash and creepage of conventional friction-lock controls. Developed as an aircraft throttle control, the vibration-proof lock is now available in a variety of sizes and models for applications in the industrial and control fields, including food processing machinery, automation equipment, and chemical and petrochemical processes. It has three prime elements: two lock-

No Bonnet-Joint Maintenance—No Bonnet-Joint Leakage



These valves helped the maintenance crew win a losing battle

This process industry plant saw the danger signal. Servicing leaky valve bonnet joints was taking too much time. Other important maintenance work was being neglected.

That's why, in 1947, when expanding the power plant, Crane Pressure-Seal Bonnet Gates were chosen for main steam service as shown above. Working pressure: 600 psi at 725 deg. F.

These Crane valves need no bonnet joint maintenance. The joint is leakproof—sealed tight by internal fluid pressure. Crane alloy seats and flexible wedge disc make closure tight and easy.

To date, the Crane Pressure-Seal Gates have given this plant over 9 years' uninterrupted service. The maintenance crew hasn't touched them except for routine care.

Full information on these modern power service valves is given in Circular AD-1936. Get a copy from your Crane Representative or by writing to address below.

Ask for Circular AD-1936

CRANE VALVES & FITTINGS

PIPE • PLUMBING • KITCHENS • HEATING • AIR CONDITIONING

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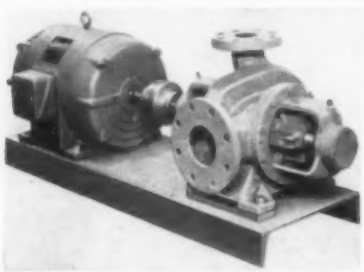
ing shoes (one for each direction) and the quadrant. Two self-aligning shoe pins, on opposite sides of common center, engage the underside and outside of the quadrant. Locking action is automatic at an infinite number of settings. This feature eliminates manual locking and unlocking, as well as adjusting, rechecking and resetting of controls. Primary lever responds freely, while secondary or driven lever is always locked and cannot be moved by vibration or feedback loads. Locking mechanism can be stacked for multi-control units on ½ in. centers. Bulletin RM-5 gives details. Reid Metal Products, Inc.

8—TERMINAL BLOCK locks into place and holds tight

The Cam-block is designed to eliminate need for lugs and soldering and screws. Employing a V-cam action, it is open for wire insertion by a simple quarter turn; a reverse quarter turn locks it into place. According to manufacturer, the harder the wire is pulled, the tighter it becomes. The device is said to offer easy access for rapid field repair. Each station can hold from 0.010 to three No. 14 wires. Willor Mfg. Corp.

9—BOILER FEED PUMP is turbine type, two-stage unit

Extra long service is claimed for this turbine type, 1750-rpm, two-stage, center-mounted pump line. Features announced for the Power Plant Feed Pumps include DuraHard electrolized impellers with surface hardness of 1100 Brinnell to resist erosion; double row permanently lubricated ball bearings; balanced radial shaft loading; Flexi-matic shaft seals with pressure-relieved "boxes." It is noted that the design permits "pulling" of shaft seals from end of shaft through bearing aperture without dismantling the pump. Pumps are available in capacities to 150 gpm, pressures to 300 psig. Bulletin 65 gives data. Fred H. Schaub Engineering Co.



10—EPOXY KIT for electrical maintenance and repair

Epoxylite Black Sealer Paste No. 203 is packaged in handy kit form which contains 20 jars of paste, complete application accessories, and instructions. Kit material is tough, chemical-resistant, highly adhesive insulation that cures in place without heat. According to company, transformer leaks can be sealed in a few minutes while the transformer is still in place. Meter cases can be repaired and broken ceramic bushings returned to service, good as new in a half-hour. Bakelite or slate terminal boards and arc chutes can be repaired on-the-spot. The Epoxylite Corp.

11—SETTLING TANK offers major design improvements

For removal of solids from water, sewage and industrial wastes, the Uniflow Tank combines a rapid sloping bottom with multiple effluent weirs. This advance design is said to increase efficiency of solids removal, offer economical construction and, as its name implies, maintain the velocity of liquid throughout the tank at as nearly uniform a rate as practical tank construction allows. Company's Straightline sludge collectors are utilized for removal of scum from surface of liquid and sludge from bottom of tank. Folder 2648 gives full details. Link-Belt Co.

12—CONTROL SYSTEM for water unit ventilators

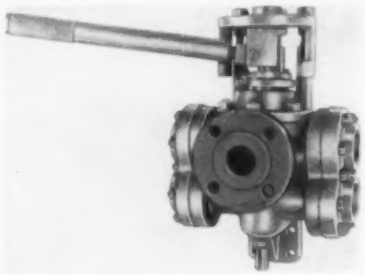
This automatic control package is specifically designed for controlling combination hot and chilled water unit ventilators. Combining a dual element, unit-mounted room and discharge controller with an oil-submerged spring return motor operator and a change-over thermostat, it provides a control system for both room and discharge temperatures. The control package consists of two separate assemblies: the control motor with change-over relay; and the dual element, unit mounted controller and strap-on thermostat. Both assemblies are prewired and equipped with plug-in cables. Control change-over from heating to cooling is automatic. The strap-on thermostat, mounted in each unit and set to change-over at 65 F, senses whether supply medium is hot or chilled water and activates unit ventilator control system accordingly. Data Sheet F 8527 gives details on the system. Barber-Colman Co.

13—DIRECT DRIVE FAN for exhausting gases or fumes

An extended shaft orifice ring fan, the Type ES is designed for operations where the motor must be kept out of the air stream. It is intended for exhausting gases or corrosive fumes, but may also be used to circulate high temperature air for drying. Featuring an aerodynamic blade design, the fan wheels produce high pressure characteristics yet maintain a low noise level, says manufacturer; and blade angles, large at the hub, decrease to small values at the tips for a uniform air pattern. Steel or aluminum wheels are available with two to eight blades, in fan sizes from 24 to 42 in. Ball bearing motors are designed to operate in horizontal or vertical position. Chicago Blower Corp.

14—TRANSFER VALVE for duplexing equipment

Cash Standard Type 45 is introduced for duplexing two strainers, heat exchangers or other equipment where fast and smooth transfer of flow from one unit to another is required. The valve has six ports, including a common inlet and outlet. Flow is through the single inlet, to either of two pieces of equip-



ment, and out the common discharged connection. This valve is designed to provide transistion of flow from one unit to the other on a proportional basis, to assure a continuous flow during transfer. A single operating handle jacks up the plug before rotation so that transfer can be made effortlessly, it is noted, and the plug cannot be rotated until it is clear of the seat, and an indicator shows position of the plug at all times. The handle also has an adjustable caming device for seating the plug. The valve comes in two sizes: 1-in., 600-lb flanged, and 1½-in. 150-lb flanged. A. W. Cash Co.

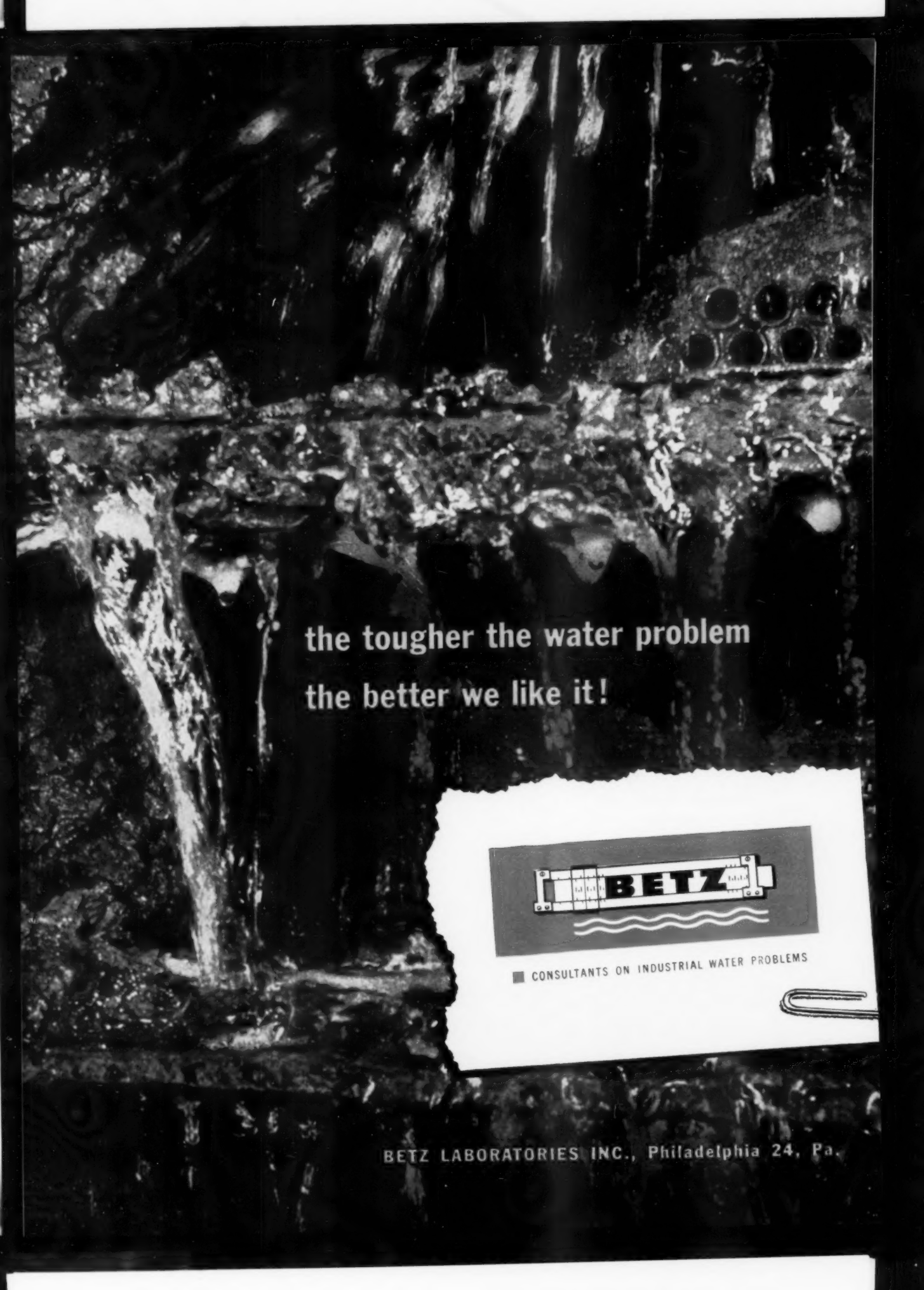
15—TRANSFORMER is 250-kva, pole-mounted unit

Announced as especially suited for applications in congested areas, this 250-kva pole-mounted transformer extends ratings in this company's line of distribution transformers from 167-kva, largest units previously manufactured. The new one weighs approximately 1700 lb, about 300 lb more than the 167-kva units, and is well below standard weight limits for pole mounting, it is pointed out. Electrical performance is reported comparable to the 167-kva unit and lower ratings. Westinghouse Electric Corp.

16—MINIATURE LUBE SYSTEM is low cost, low pressure type

Accumite is a low pressure, positive displacement type of miniature lubrication system for use on machinery having numerous bearings and limited installation space. Accumite centralized systems are specifically designed to lubricate machinery previously not considered for centralized systems for economical or structural reasons. Among these are: production machines; high precision machines; machines with many bearings; difficult to lubricate machines, where personnel safety is endangered.

Heart of the system is a miniature metering valve (slightly larger than a lubrication fitting) which services each bearing individually. This valve is designed to deliver a specified amount of clean lubricant to each bearing connected in the system regardless of bearing clearance or distance of bearing from pump, and to eliminate lubricant drainage from the system when the


the tougher the water problem
the better we like it!
BETZ
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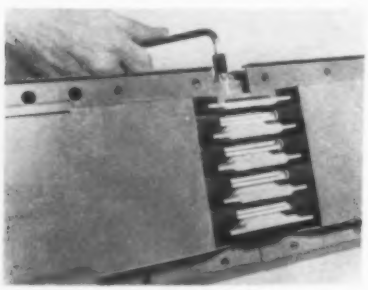
BETZ LABORATORIES INC., Philadelphia 24, Pa.

machine is idle. The system can handle a wide range of lighter grade lubricants, and offers four types of lubricant pumps to pressurize the system lines and actuate the measuring valves. These pumps deliver enough lubricant to serve 40 to 200 bearings in one stroke. Alemite Div., Stewart-Warner Corp.

17—BUSWAY SYSTEM designed for aluminum conductors

Rated 225 to 1000 amp, of plug-in design, Type DE Busway is announced as up to 50 per cent lighter and 30 per cent smaller than other busway of comparable ratings. It is also reported to have features that lower installation costs as much as 50 per cent. Type DE Busway comes in three-pole and three-phase,



four-wire designs for maximum 600-v applications. It offers as standard 50,000 amp RMS asymmetrical (40,000 RMS symmetrical) short-circuit capacity. Cost reducing features announced include: a one-bolt joint (shown) that can be tightened with a single key-type wrench to exert up to a ton of force on the overlapping conductors; snap-on hangers; and an adjustable length, which allows a 1-ft adjustment of a run on the job site. It can also be hung on 10-ft centers, instead of the usual 5-ft centers, regardless of position in which busway is hung, manufacturer notes. The aluminum conductors are silver-plated and tubular in design, encased with a heavy butyl insulation. A variety of fittings is available. General Electric Co.

18—TEMPERATURE SCANNER provides multi-point protection

This versatile multipoint temperature scanner is designed to provide over-or under-temperature protection for systems where it is mechanically or economically desirable to provide one temperature alarm instrument capable of sensing several control points and providing alarm if one of these temperatures exceeds or fails to reach a pre-set limit. From four to 56 thermocouples are connected to a stepping switch which samples the output of each thermocouple. The signal is then delivered to the signal terminals of a contact meter.

As long as each temperature is below (or above) the limit established on the contact meter, no alarm is sounded. If any of the points scanned should be beyond the set-point, an alarm is sounded and a light corresponding to the offending thermocouple remains lit and scanner is stopped at that point. The alarm can be located close to points monitored or at a more remote location. Scanning rate can be as rapid as ¼ sec per point, but scanning rates providing 5 to 60 sec of dwell-time on each thermocouple is considered practical. Tipptronic, Inc.

19—PIPE INSULATION features built-in tie wires

101 Pipe Insulation is a speed-fastening, high-temperature pipe covering incorporating built-in tie wires. Manufacturer says it can be applied to large diameter lines as rapidly as more costly molded pipe coverings. Felted from high-temperature, moisture-resistant spun mineral wool, this insulation is reported to withstand temperatures to 1200 F. Its exterior surface is faced with a metal fabric of 16-gage wires tied through the spun wool to an inner facing of 1-in. expanded metal lath. Speed fastening is accomplished by hooking seven wires which extend from one end of the outer mesh fabric under the opposite stay wire and bending them over and back.

It is noted that 101 Pipe Insulation is well suited for covering nested pipes and steam traced lines, as shown, since it can be manufactured to fit exactly with no waste material. Having a low

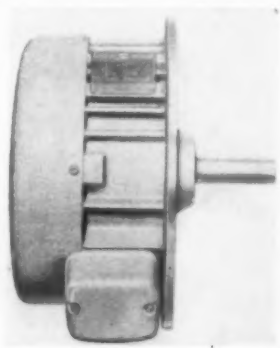
alkalinity factor, it will not corrode pipes in the presence of heat and moisture, it is stated. The insulation comes in 2-ft. sections and 1½- to 4-in. thicknesses for pipe sizes from 4 to 30 in. It is specifically designed for runs of pipe to be weatherproofed with sheet metal or roofing felt. Baldwin-Hill Co.

20—PHOTO RELAY with printed circuit board in steel cradle

This printed-circuit photo relay comprises a printed-circuit board held in a sheet-steel cradle which fits into a conventional conduit box of the one-gang type, just as a switch would. The board contains all of the parts on one side, and the etched wiring on the reverse face. The result is described as a compact, rugged assembly that is easy to wire and use. There is no amplifier tube, no warm-up and no internal heating. Operation is from 100–130 v, 50/60 cycles, and control is from about 10 ft-c of light into the lens. Manufacturer says this photo relay is low in cost due to its simplicity. Photobell Co., Inc.

21—SHALLOW MOTOR for use where space is limited

Length reductions up to 60 per cent over standard motors of the same rating are claimed for the Pancake Motor. It is designed for use on machine tools, roof-ventilating fans and other space-cramped



applications. The Pancake Motor is a flange type unit of conventional radial air-gap design; it achieves its shorter length through formed end coils and a one-piece housing-bearing bracket. For normal operating conditions it is built in an open drip-proof enclosure, but enclosed construction can be furnished for use where dirt, corrosive chemicals etc., are present. It is available in ratings from 1 to 15 hp at 1800, 1200 and 900 rpm. Features include vertical or horizontal mounting, quiet operation. Bulletin 2100 gives data. The Louis Allis Co.

Reader Service Cards on pages 105–106 make it easy to get further information on any of these products. Just circle the item numbers of the products you want to know more about.

22—SELECTOR VALVE for switching liquid flow

For automatically switching the flow of liquids, under pressure from one tank to another or from a series of tanks to processing, this simple valve can be inserted in lines where tanks are equipped with individual pumps or where the pressure through gravity permits. It is designed to direct the flow of liquid from one or all tanks at the same time and to seal off the empty one when operating from all tanks. When feeding from one tank at a time, the valve frees an operator from watching gages and tanks as critical low points are reached, company points out; he can throw a full tank in any time before this point is reached. Both tanks will feed liquid until the first runs dry, at which time the second takes over, says manufacturer, and such a setup can include any number of tanks. This selector valve has a pressure range of 100 psi. It has only three parts and is said to be unaffected by temperature, to be fast acting and to create no pressure drop or flow restriction. It is designed to handle any fluid that can be pumped, or any gas, and can be furnished in many sizes and metals. New Products Corp.

23—PACKAGED DRIVES for adjustable speed control

Speed Variators come in ratings of 3 through 150 hp and in speed ranges of 8 to 1 and higher. These packaged adjustable speed drives are designed for use on continuous processing lines, calender drives, machine tools, crane hoists, metal rolling mills and wherever adjustable speed for fine control is needed. Company's Amplistat regulator with silicon rectifiers is standard on the line, and is designed to provide smooth, timed acceleration and deceleration to preset speed in addition to voltage regu-

A NEW LESLIE FINAL CONTROL ELEMENT

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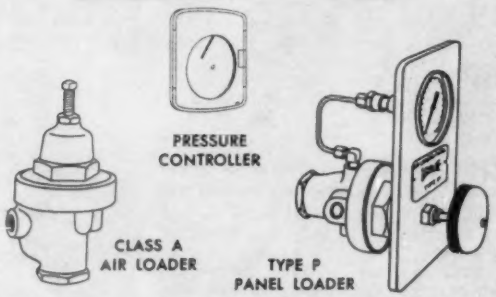
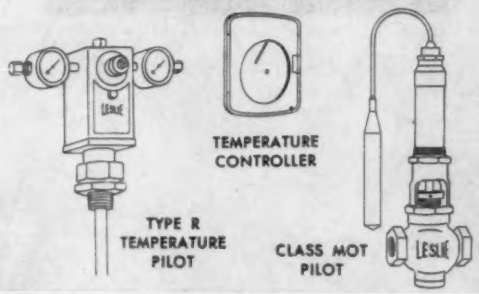
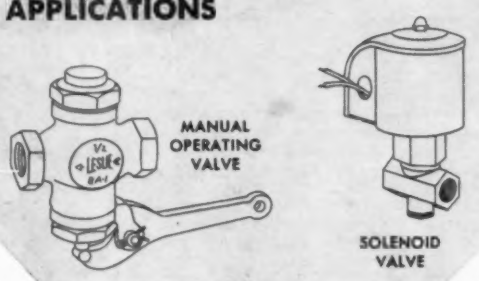


TEMPERATURE REGULATION



REMOTE STOP VALVE APPLICATIONS



packless!* double*

A REALLY VERSATILE CONTROL VALVE — with only two moving parts and a metal diaphragm*

Now, simplified instrumentation combines the simple air loaded, Leslie diaphragm operated valve with various air operated devices. This is the valve that filled a real need when introduced about a year ago, wearing a 3-year guarantee against maintenance in normal pressure reducing services.

This new final control element is gaining wide acceptance for use with a variety of pneumatically operated controllers — simplifying pressure reductions, temperature regulation, remote stop valve applications and many process steam control services.

Ideal for "problem" installations

This control valve is ideal for either continuous or intermittent service and has remarkable immunity to dirty steam. Furnished in cast iron, sizes ½ - 2", it is suitable for any steam service up to 250 psi, 450F, and many fluid services.

It's simple — it's accurate

This Leslie control valve has only two moving parts ... no fussy seals, no stuffing boxes, no small dirt-catching parts; yet, with all its simplicity, it provides uncanny accuracy with its feed-back action. It lends itself readily to remote adjustment, too.

More Information

Ask your Leslie engineer to tell you more about this really versatile valve and the simplified instrumentation "packages" now available. You'll find him listed in your classified directory under "Valves" or "Regulators" and eager to come up with new ideas for simplifying pressure, temperature and liquid level control systems.

Send for Bulletin 561-A

* These are the President's comments — even the ad manager didn't know all the fine features!

LESLIE REGULATORS and CONTROLLERS

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lation. The static excitation system with silicon rectifier has no moving parts and needs no warm-up period. The motor-generator set is of two-unit, four-bearing design, in which company's Tri-Clad 55 a-c motor and d-c generator are connected by flexible coupling. Standardized power unit control devices are unit-mounted and front connected. Smaller and lighter, the units can be installed end-to-end, end-to-wall or within 6 in. of back wall. General Electric Co.

24—HYDRAULIC HANDGUN simplifies plug valve lubrication

Announced as lighter and more rugged than many hand guns, the 400-C is self-priming and can be used in any position. Because of the extra-high pressure this gun exerts, the hose and coupler can be locked to the buttonhead fitting in the valve shank. The pressure may be relieved by a turn of the by-pass valve on the gun, permitting separation of buttonhead coupler and

fitting. Among other protective features noted are a relief fitting on the hydraulic system to guard against injury to the gun if the operator continues to pump after the gun is empty. A 15,000-psi gage is utilized to indicate point at which sufficient lubricant pressure has been developed in the valve — signaling this by a sudden drop in pressure reading. The gage also indicates valve adjustment and other services required, and has a recalibrator screw for easy corrections in case it is knocked out of adjustment by rough handling. Bulletin V-608 describes the gun. Meter and Valve Div., Rockwell Mfg. Co.

25—POWER SUPPLY is air insulated, selenium rectified

Beta Model 4250–2, an air-insulated selenium-rectified 250kv, 2 ma power supply, is announced as the first in its range to be offered commercially. Use of selenium rectifiers results in long service, manufacturer states, and filament transformers operating at high potentials are not required. Servicing is reported easy, since all high-voltage components are accessible. Model 4250–2 has an input voltage of 105 to 125 v, 50 to 60 cycles, single phase, input power of approximately 1 kva, continuously variable output voltage, manually reversible polarity, approximately 2.5 per cent ripple at maximum rated power output, internal impedance of 11 ohms, 0–250 kv voltmeter and 0–5 microammeter with ±3 per cent full scale accuracy. Among protective features announced are provision for external safety interlock, zero start interlock, fixed overcurrent and overvoltage relays preset for 110 per cent of rated output, and short circuit surge current limiting resistor. Beta Electric Div., Sorensen & Co., Inc.

26—FLEXIBLE LACING for troughed conveyor belts

Minet-Splice is described as an easy-to-use, high strength flexible lacing for troughed conveyor belts. Templates, drilling and hole punching are not required for this heavy-duty, hinge-type splice, manufacturer states, and it is

installed in one piece. As the conveyor operates, the hinge plate separates into sections at pre-scored notches to conform with conveyor trough curvature. The one-piece design is said to assure the closest possible fit. High strength — reported up to 68 per cent of belt tensile limit — is attributed to the method of fastening which employs pointed rivets which separate but do not cut the fabric. The splice is designed to go smoothly around small diameter pulleys and facilitate adding and removing belt sections. It is available for belts from 3 16 to ¾ in. wide. General Splice Corp.

27—TEMPERATURE CONTROL features dual mounting

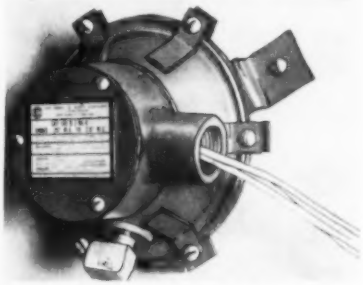
Model MFS is a mercury-actuated indicating temperature control incorporating a dual mounting design and offering improved readability. Reported accurate to within ½ per cent of scale range, the controller is designed to sense, indicate and control processes and appliances with the extreme ranges of −30 to 1100 F. It is available in 10 scale

ranges. Suggested applications include all types of process operations, industrial ovens, furnaces and packaging lines where temperature tolerances are close.

Designed into the instrument is a feature called "Accu-Vision" said to provide accuracy in setting and reading and to virtually eliminate possibility of human error. This includes an increased dial area, a magnifying pointer with two hairlines for parallax sighting, and an optically-designed combination of dial colors for greatest contrast. The mounting arrangement of the Model MFS lets the case be either flush or wall mounted without additional brackets or hardware. Mounting can be done from the front of the panel. Designed by the Raymond Loewy Associates, this instrument is described in detail in Bulletin 320. The Partlow Corp.

28—CONTROL senses low pressure, vacuum, differential

Catalog 130 Control is designed as a single setting, variable actuating value, sensitive static pressure, vacuum or differential pressure control for application to sensing pressures or vacuums of 0.05 to 40 in. water column. The control comes in three diaphragm sizes. Pressure settings are readily adjustable by an ad-



justing screw. Fixed on-off differentials, from 0.05 to 4 in. water column, depending on diaphragm sizes, are obtainable. Controls are suitable for air, gases, liquids, or water when using pressure connection. Vacuum connection is usable only with air or inert gases. Electrical ratings of the single-pole, double-throw contacts are 15 amp at 120–250 v a-c, ⅛ hp or 125 volt amperes pilot duty. For best operation the switch should be mounted on a vertical surface, manufacturer states. The Henry G. Dietz Co.

29—EXPANSION JOINT takes longitudinal, lateral movement

Penflex Expansion Joints are offered for conveying air, gas, volatiles and liquids, in installations where settlement, vibration or thermal expansion are factors. They are available for such industrial installations as diesel exhausts, water or oil lines, steam line expansion, air service for boiler draft systems, conveying hot liquids. These expansion joints can absorb longitudinal and lateral movement in one cycle, manufacturer states; opposite ends of the joint can move laterally in opposite directions to complete an expansion cycle. In making lateral movements, the tubing extends itself to permit the flanged end to remain in the same parallel line with the original installation.

It is explained that all movements of the expansion joint are absorbed by free movements of each interlocked joint sealed with packing for high operating pressures. When expansion cycle is completed, interlocked joints lock the tube in a fixed position, relieving stress and strain on auxiliary equipment. Company says these joints can be lagged with fireproof insulation for fire protection without affecting flexibility. They come in sizes from 4 to 26 in. ID with rigid or floating Titepak flanges; bursting pressures of the joints range up to 1200 psi. Pennsylvania Flexible Metallic Tubing Co.

more Equipment News page 118

How your truth dollars help keep the Reds in the red

• The truth dollars you give to Radio Free Europe help keep truth on the air behind the Iron Curtain.

And the truth is an enormously disruptive force to the Reds. For it keeps their captive people thinking . . . wondering . . . and less than completely dominated. The truth keeps needling the Reds. Breaks through their monopoly of lies. Keeps them unsure. Off balance. And thus the truth keeps up to forty fully armed Red divisions tied up policing Russia's satellite countries. Forty divisions, mind you, that might otherwise be put to more aggressive use elsewhere . . . and who knows where?

Your truth dollars keep the 29 super-powered transmitters of the Radio Free Europe network on the air . . . broadcasting the truth behind the Iron Curtain . . . every hour of every day.

Why *your* truth dollars?

Because Radio Free Europe is a private, non-profit organization supported by the voluntary contributions of American business and the American people. And *your* dollars are urgently needed to keep it on the air . . . to help operate its transmitters, pay for its equipment and supplies, and its scores of announcers and news analysts in 5 languages.

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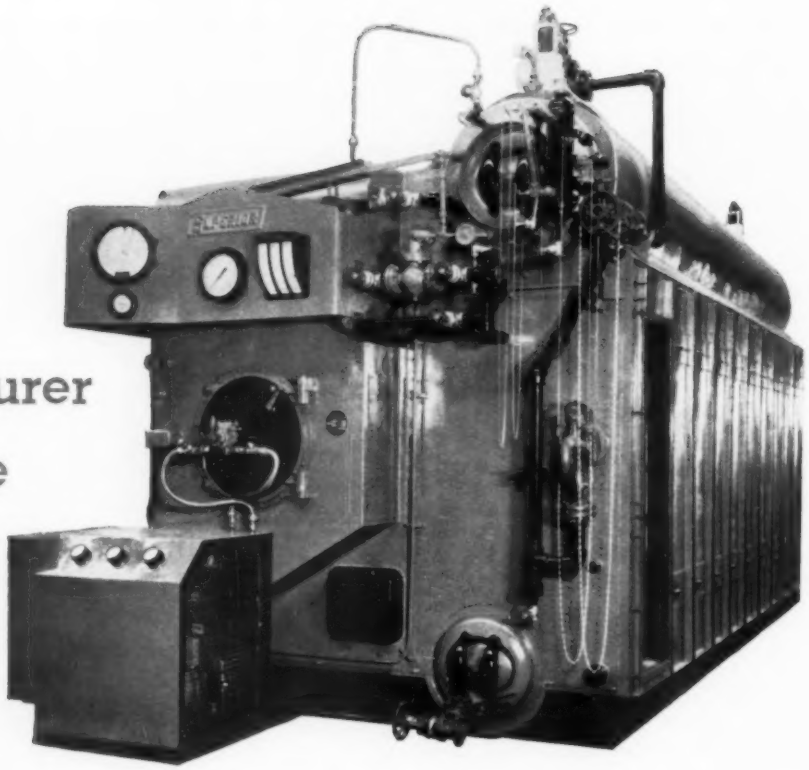

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Capacities to 50,000 lbs. per hour.
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Low and high duty superheaters.
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All this with undivided responsibility, guaranteed performance and efficiency for minimum maintenance.

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MECHANICAL POWER TRANSMISSION

201 V-S Drive Selection Tips — Bulletin 20P50, 44 pp, carries handy multicolor tables for quick and easy selection of variable speed Texrope drives. In addition to providing these tables for A, B, C and D section variable speed drives, booklet includes information on design features, drive principles, horsepower rating tables, speed range table. Allis-Chalmers Mfg. Co.

202 Internally Geared Power — Featuring latest design improvements in gearmotors and embodying 60 multicolor illustrations, 16-pp Form F-1880 shows comparative advantages of gearmotors, lists ratings from ⅛ to 30 hp with gear ratios as high as 10:1. Cross-sectional details and enlargements of outstanding features are included, as well as a discussion of use of elliptoidal helical gears, and a chart graphing degrees of tempering of gear teeth. U. S. Electrical Motors Inc.

203 Fluid Drives — Bulletins 9419 and 9519 are an illustrated catalog and selection guide on company's new Type VS Class 2 Gyrol fluid drives. Catalog discusses advantages and applications of the drives, covering speed control, power savings, simplified installations, etc. A sectional view shows construction and principle of operation. Dimensions for six sizes of drives are provided. Selection guide consists of tables indicating proper drive to use. American Blower Corp.

204 Flexible Cushion Coupling — Bulletin A669, 12 pp, describes the Paraflex, a flexible cushion coupling, designed to automatically compensate for all combinations of misalignment and end float. Cutaway views and drawings are included, as well as coupling selection data and a table listing service factors for couplings. Dodge Mfg. Corp.

VALVES, TRAPS AND PIPING

205 Check Valves — Twenty-pp Catalog 30 presents company's line of tilting-disc check valves made in iron, bronze and steel for working pressures to 3000 psi. Explains operating principles of tilting disc construction, discusses closing without slam, reduced loss of head, other advantages. Includes construction details, sizes. The Chapman Valve Mfg. Co.

206 Boiler Blow Off Valves — Bulletin E-125, 24 pp, describes and illustrates the design and construction of company's quick-operating valves, angle valves, Y valves and duplex units specifically designed for boiler blow-off service. Includes dimensions. Everlasting Valve Co.

207 Water Hammer Control — Cause, effect and control of water hammer in piping systems is the subject of 8-pp

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Bulletin WH 851. Photos, drawings and curves supplement text, and test data is presented to show efficiency of company's silent check valves in water hammer control. Some typical installations are illustrated. The Williams Gauge Co., Inc.

208 Lubricated Plug Valves — Catalog PV-24, 36-pp, shows in detail a line of iron and steel lubricated plug valves. Many illustrations of the single, screwed and bolted gland type valves are shown, including photos, sectional and detailed drawings. Also included is physical data on dimensions. The Wm. Powell Co.

209 Choosing the Right Valve — Presenting valve selection as a matter of matching the valve's service characteristics with service requirements of the job, this practical 20-pp booklet explains and illustrates basic design features of gate, globe and check valves. It tells, in non-technical language, how each of these valve types works, and where it is suited for use. Disc, stem connection, bonnet and bonnet-joint characteristics are discussed and illustrated. Crane Co.

210 To Get at Those Valves — This little folder describes a sprocker rim with chain guide. The rim adjusts to fit all valve wheels. Babbit, Steam Specialty Co.

211 Industrial Valves — Bulletin 507V illustrates and describes company's line of industrial valves for control of air, gas, liquids and solids. Features photos and descriptive detail on a variety of valves, including butterfly valves, wafer butterfly valves, treaded butterfly valves, slide valves, check valves, proportioning valves and others. W. S. Rockwell Co.

212 Industrial Valves — Condensed Catalog 105, 28 pp, contains data on valves for a wide variety of applications. Includes dimensions and illustrations describing non-return (stop-check) valves, globe and angle stop valves, pressure seal design, angle univalves and small size globe valves designed for chain or extension operation in vertical lines. Also included is company's Mudwonder valve for abrasive fluids. Edward Valves, Inc.

213 Butterfly Valve Manual — Forty-pp Catalog B-2 is designed to help power engineers select valve types, understand their characteristics, and determine space requirements. It includes such useful data as: pressure drop and flow tables, conversion tables, theory and application, recommended materials, and describes rubber seat butterfly valves from 4 in. diam up, for handling liquids and gases. Photos, drawings and diagrams amplify the text. The Henry Pratt Co.

214 Valve Digest — Form 197R is a valve catalog digest furnishing the latest coverage of the OIC bronze, iron, cast steel, forged steel, and lubricated plug valve lines in a condensed form. Valves are classified by type and pressure class, and illustrated; this edition also includes face to face dimensions for each size and type of valve listed. The Ohio Injector Co.

215 Impulse Steam Trap — Bulletin T-1742, 8 pp, describes a line of impulse steam traps designed for a variety of trapping requirements. Contains information on operation, materials and capacities and includes dimensional and specification data, as well as photos of typical installations. Yarnall-Waring Co.

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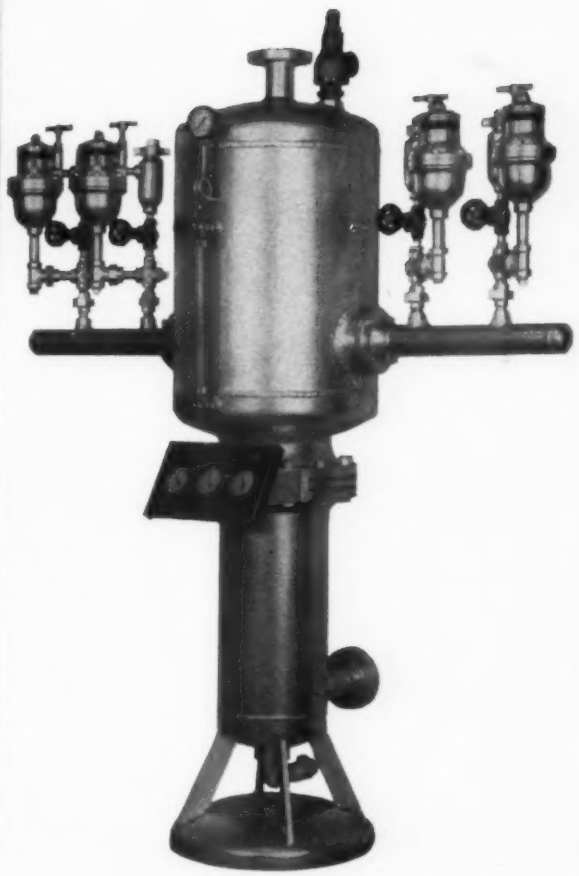

Madden Package Heat Recovery Systems are designed with the Operating Engineer in mind. Once the blowdown water leaves the boiler, it travels in only one direction . . . down. The result is no mud traps, no clogging and CLEANING IS ELIMINATED.

Accurate, wide range flow control with the Madden Orifice Meter. The heart of this device, the Orifice Plate, is GUARANTEED FOR TEN YEARS against cutting, wire drawing or any other distortion. The amount of blowdown becomes a definite and known quantity. Four different Orifice Plates, each with 17 orifices, are available to meet varying requirements.

The NEW Madden Balanced Pressure Float Valve located in the flash tank is constructed with a stainless steel mechanism, including the float ball. This valve allows the correct flow of blowdown water to escape at all times to the heat exchanger tubes, thereby providing a flushing action. Only Madden provides SELF FLUSHING and GRAVITY FLOW.

Boiler capacity usually expands in proportion to factory capacity and the Madden System also has this ability to grow but without the addition of new units. ONE HEAT RECOVERY SYSTEM CAN BE OPERATED WITH AS LITTLE AS ONE BOILER AND AS MANY AS SIX! Top efficiency can be expected through its complete capacity range.

The System is sold and shipped as pictured. Standard accessories include a gauge panel, pressure relief valve, manifold, gauge glass set and a hand hole in the flash tank for easy access to the float valve. There is nothing more to purchase, construct or install. Connect the piping and you immediately begin to receive dividends. Additional boiler horsepower and lower boiler maintenance are only a small portion of the advantages of the New Madden Heat Recovery System.

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MADDEN GAUGE PANEL shows conditions of system and provides factors for easy calculation of B.T.U. savings.

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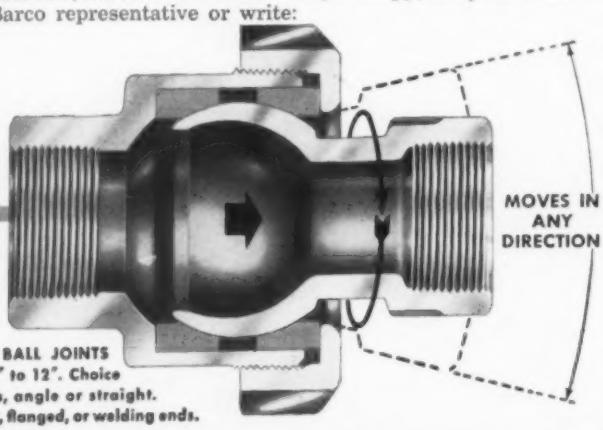
BULLETIN No. 31

EVERY ENGINEER will want a copy of this NEW BULLETIN

CERTAIN distinctive characteristics and features make Barco Flexible Ball Joints particularly well-suited for solving many present-day plant piping design problems, especially for *Steam Service:*

1. Ability to handle compound movement (where twisting is combined with thermal expansion and contraction).
2. Virtually no deterioration. Able to stay in service for years without repairs or maintenance. No lubrication.
3. No heavy pipe anchoring required. No "end thrust" developed under pressure. Minimum space needed for installation.
4. Maximum safety for high temperature applications. All-metal construction available. Special metals can be specified.
5. Basic design is pressure sealing against leakage and self-adjusting for wear. Suitable for steam pressures to 750 psi and higher.
6. Easy to engineer joints into piping to provide for any degree of flexibility, expansion, or movement required.

New Bulletin No. 31 contains interesting diagrams showing how to solve many common pipe expansion problems EASILY, ECONOMICALLY. *Ask for a copy;* see your nearest Barco representative or write:



BARCO BALL JOINTS
Sizes ½" to 12". Choice of styles, angle or straight. Screwed, flanged, or welding ends.

BARCO MANUFACTURING CO.
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BARCO ANNIVERSARY — 50TH

The Only Truly Complete Line of Flexible Ball, Swivel, Swing and Revolving Joints
In Canada: The Holden Co., Ltd., Montreal

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216 Steam Traps — Quick-Flex thermostatic steam traps for outdoor and non-freeze service are described in Bulletin 257. Itemizes typical uses for these traps. Specifications and capacities are given in tabular form, accompanied by dimensional drawings. Diagram shows recommended installation. The V. D. Anderson Co.

217 Insulated Piping — Bulletin 57-1, 24 pp, on prefabricated insulated piping systems, shows typical uses for Hel-cor pipe units for underground or overhead pipe systems. Also describes Utilidor conduits for protection of underground utility services. Sample specifications are given, along with conduit sizing charts. Ric-wil, Inc.

218 Materials for Main Steam Piping — Entitled "The Plastic Ductility of Austenitic Piping Containing Welded Joints At 1200 F," this 16-pp bulletin deals with an investigation into the problem of selection of materials for main steam piping. Gives stress rupture characteristics of type 316 and 347 stainless steel piping adjacent to welded joints. Pittsburgh Piping and Equipment Co.

219 Flexible Ball Joint — Catalog 215-B, 20-pp, describes advantages of company's flexible ball joints for use in piping for power, process, heating, chemical, construction, or hydraulic service. Includes engineering specifications and data on the standard 300 lb series and the series 600. Screwed, flanged and welding end joints are listed, as are insulating joints and jacketed joints for handling asphalt and other liquids that solidify unless heated. Barco Mfg. Co.

PUMPS, PUMPING

220 Controlled Volume Pumps — Bulletin 953, 24 pp, describes and illustrates use of controlled volume pumps in industrial water treating systems. Construction and operation features are described, capacity-pressure ranges and speed and stroke length adjustments are charted. Typical chemical feed and water testing systems are presented through text and diagrams; and an analysis of boiler water treating systems, cooling water treating problems, and systems for waste and sanitary water treatment included. Milton Roy Co.

221 For Abusive Pumping Jobs — Catalog 4906, 36 pp, covers centrifugal pumps for wide industrial use and especially adapted to handling ashes, abrasive mixtures, slurries, hot and corrosive liquids. It describes several basic types: a horizontal shaft, single-stage side suction pump; a horizontal shaft, single-stage, rear-entrance automatic priming pump; vertical shaft pumps with standard, overhead and quill bearings for wet pit applications. Nagle Pumps.

222 Non-Clog Pumps — Bulletin 121MV features Mono-Vane single passage impeller pumps designed for handling heavy settleable solids, long stringy solids, effluent etc. Both horizontal and vertical types are presented along with specifications. Mono-Vane impeller is described in detail, and various models of the pumps are pictured. Aurora Pump Div., The New York Air Brake Co.

223 Proportioning Pumps — Catalog 602, 8 pp, covers details and specifications of two mechanical and hydraulic drive metering and proportioning pumps, for precision pumping as low as 11 cc per

min, and a chemical pump for systems requiring limited capacities. Advantages are enumerated and capacities and pressures tabulated. Hills-McCanna Co.

INSTRUMENTS, CONTROLS

224 Meters and Controls — Over 100 measuring, transmitting, receiving, recording and indicating instruments and control components, including those introduced within the last year, are described in the 8-pp 1957 edition of company's Bulletin G15-1. Applications, ranges, and detailed literature references are given for each product. Bailey Meter Co.

225 Instruments, Controls — Condensed Catalog 1537 offers brief application information on manufacturer's line of instruments. Fully illustrated, covers draft and pressure instruments, flow meters, liquid levels and pressure gages, CO_2 meters, pneumatic transmitters, positioning operators, temperature instruments, boiler feedwater controls, others. Includes references to detailed literature on each type of equipment. Republic Flow Meters Co.

226 Easy Reading Gage — An all-hydrostatic remote reading gage for boiler water and other liquid levels is described in Catalog 500, Section CO. Pictures improved visibility, other advantages offered by this gage, and explains operation. The Reliance Gauge Column Co.

227 Bi-Color Gage — Bulletin 1174 gives advantages of company's Multi-Port bi-color gage made for boiler operating pressures to 3000 psi. Points out chief design features, illustrates construction details through photos and drawings. Diamond Power Specialty Corp.

228 Pressure Regulators — Form 1011, on flow regulators, provides selection data with photos on three principal types of main valves and pilots. Also illustrated by line drawings are three suggested applications of regulators. A steam capacity table for the selection of main valve size is also shown. Spence Engineering Co., Inc.

Do any of these catalogs answer your operating or maintenance needs? Let us know by circling the number of the catalog on the post card provided on pages 105–106. We'll do the rest!

229 Cooling Controls — Bulletin 710B describes company's self-powered cooling controls for compressors, stills, solvent coolers, degreasers, oil coolers, small engines, condensers, others. Includes hook-up sketches. Sarco Co., Inc.

LUBRICATION

231 Versatile Industrial Oil — Described in 20-pp Form AD 4078 is an all-purpose oil offering protection for a wide range of industrial equipment, and available in 15 viscosity grades. Discusses six major characteristics of the oil; explains and pictures its use in hydraulic systems, speed reducers, air compressors, electric motors, hydraulic turbines, bearing systems, etc. A chart shows grades available, uses, properties. Standard Oil Co. (Ind.)

232 Lubricants — Specification, Classification — Vital information on

GOODALL *Rubber*
EXPANSION JOINTS

LOWER INSTALLATION COSTS...

Goodall Rubber Expansion Joints are easier to install on new construction or as replacements. They are light in weight, with short face-to-face dimensions. Retaining rings or flanges are quickly aligned and bolted. No gaskets are required. The installation takes less time . . . at a saving.

LONGER SERVICE LIFE...

Goodall Rubber Expansion Joints last longer in service because of inherent characteristics of the material from which they are made. There is *no embrittlement* . . . continuous movement (flexing) actually keeps the rubber joint "alive". There is no corrosion or electrolysis. Resistance to abrasion is exceptionally high. Replacement costs are lower.

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With Goodall Rubber Expansion Joints only the slightest pressure is required to create movement in any direction. Result—stress on metal pipe or other member is reduced to an absolute minimum. All styles are available in sizes from ⅜" to 96" I.D., for pressures up to 125 lbs. P.S.I. (depending on size) and/or vacuum.

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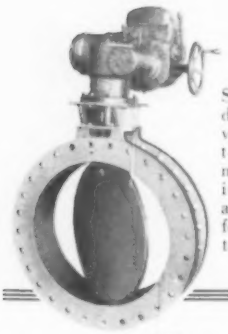
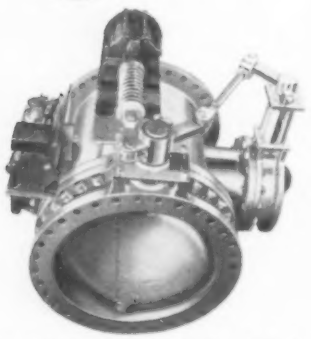
Your plant needs

ROCKWELL VALVES *like these*

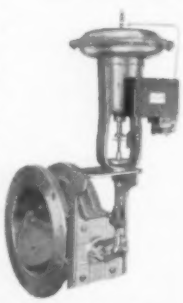


Standard heavy duty butterfly valve with Limitorque electric motor, declutching mechanism and handwheel for air, gases, water or other fluids.



Special four-way valve for hot air and exhaust gases in a gas turbine system; has 3 butterfly valves mounted on a steel pipe cross, with 2 valves connected to one hydraulic cylinder operator and one valve connected to an air cylinder with valve positioner for independent balancing purposes.

Standard butterfly valve with simplified bracket and linkage to air diaphragm operator and valve disc positioner; provides maximum adjustment, minimizes friction, eliminates backlash, chatter and hunting, reduces power requirement in close control applications.



What's your valve problem?

W. S. ROCKWELL COMPANY
2948 ELIOT STREET
FAIRFIELD, CONN.

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selection of lubricants is presented in 10-pp Vol. 41, No. 4 of "Lubrication." Covers such items as performance specifications, initial suitability of lubricants, quality of lubricant, effect of lubricant on production, effect on maintenance, effect on power, effect on cost, and features a look to the future. The Texas Co.

233 Lithium Greases — This product information bulletin presents manufacturer's six Litholine industrial greases, stressing industry advantages offered by these multi-purpose greases. Gives properties of the greases, general application and performance characteristics and includes test data. Sinclair Refining Co.

BOILERS, GENERATORS

234 Water Tube Boilers — This 12-pp catalog describes packaged water tube boilers, in capacities from 8000 to 50,000 lb per hour. Interesting as well as informative, this booklet uses color and illustrations to amplify text. Gives complete data and dimensions for boilers designed for firing oil or gas or both. Superior Combustion Industries, Inc.

235 Automatic Boilers — Bulletin BE-4 describes operation and advantages of Continental automatic boiler's spinning gas technique — a method of obtaining maximum heat transfer with a simplified design. Shows cutaway view of boiler construction; illustrates hinged doors and method of injecting air. Boiler Engineering & Supply Co., Inc.

236 Hot Water Boilers — This 20-pp brochure describes and illustrates design, construction, advantages and economies of the C-E La Mont controlled circulation hot water boiler for supplying high pressure, high temperature water for heating systems and process applications. Combustion Engineering, Inc.

237 Steam Generators — Twelve-pp Bulletin PSG-2 contains design and construction details on company's package unit steam generator — a vertical, bent tube, longitudinally fired water tube boiler. Capacities, dimensions and weights are tabulated and drawings, diagrams and photos showing fabricating methods included. Henry Vogt Machine Co.

238 Steam Generators — Illustrated Bulletin SB43, 20 pp, describes company's VL factory assembled generators combining 2-drum water-type boiler, integral water cooled furnace, brick work, insulation and steel casing. A large cutaway illustration shows design details, and gas travel. Erie-City Iron Works.

239 Standard Generators — Bulletin B-55-4 describes company's SC economy series of standard steam generators designed to reduce steam costs for industrial plants. Pre-engineered, standardized steam generators offered in nine sizes, with capacities of from 50,000 to 150,000 lb per hour are described, and schematic and cutaway drawings of design features are included. Foster Wheeler Corp.

240 Packaged Generators — Bulletin MH 3-54, 14-pp, gives detailed coverage to company's Type MH packaged water tube steam generators which are furnished for oil or gas firing or both, with automatic, semi-automatic, or manual controls. Included are: cutaway illustrations, installation photos, tube arrangement layouts, construction details, auxiliary equipment, dimensions. Union Iron Works.

This combination gives the *LOWEST COST PER HOLE in DRILLING ANY MASONRY MATERIAL!*

1 the BIT

NEW ENGLAND *Cyclo-Core*®
MULTI CARBIDE TIPPED ROTARY **BIT**

***FASTEST* in Concrete or Any Masonry Material**

- Up to 3 times faster than other core drills
- Multi-Spiral Flutes assure positive dust removal
- All cutting edges ground
- Easier to re-sharpen . . . "Do It Yourself"
- More drilling footage

SIZES: ¾" to 6" diameter . . .

Exclusive "Starting Centers" permit pin-point positioning of bit . . . prevent "walking" when starting holes.

2 the RIG

***NEW!* Cyclo-Core®** PORTABLE
MASONRY DRILLING MACHINE
for use with Cyclo-core Carbide-Tipped Bits
NO WATER REQUIRED

MODEL 6
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- Lowest possible cost per hole using CYCLO-CORE Bits.
- Minimum set-up and knock-down time.
- Drills holes up to 6" diameter in concrete with or without rods.
- Puts sufficient pressure on cutting edges of bit.
- Manually or hydraulically operated by one man.
- Permits drilling close to walls, or in corners.
- Completely portable—easily wheeled by one man. For extreme portability unit can be completely disassembled.

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NEW ENGLAND CARBIDE

Designed, Engineered, and Proven for the Job.
Cyclo-Core Bits available in sizes —¼" to 6" diameter

New England **Carbide Tool Co., Inc.**
557 Commercial St., Medford 55, Mass.

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241 Compact Generator — This bulletin describes a packaged water tube generator, company's Type DK, available in units for 8400 to 45,000 lb of steam per hour. Gives features, size and capacity data on these boilers which are designed to require less space than many water tube units. E. Keeler Co.

REFRACTORIES, INSULATIONS

242 Refractory Concrete — Basic information on recommended practice for mixing and placing refractory concrete, used in the metal, power, ceramic, and petroleum refining industry as a material to withstand service temp to 2600 F or more, is presented in this 16-pp manual. Sections are devoted to special properties of refractory concrete, aggregates, refractory insulating concrete, and structural design. Universal Atlas Cement Co.

243 Refractory Castable — Bulletin R-40 describes use of Kaocrete-32, a high temperature refractory castable, in boiler ashpits. A discussion of various methods of ash removal, along with maintenance problems peculiar to each, is presented. Four typical installations are detailed. Refractories Div., The Babcock & Wilcox Co.

244 Insulations, Refractories — This 20-pp catalog features thermal insulations and refractories for general industrial applications. Organized for quick reference, catalog provides information on composition, physical and thermal properties and sizes of the various products. Lists chief advantages, covers materials for efficient control of temperatures from −400 F to 3000 F. Johns-Manville.

245 Pipe Insulation — This 40-pp catalog was designed as a reference guide to company's pipe insulation, presenting a new way to specify proper thickness for pipe insulation, based on the "J" factor. This special index eliminates complicated computation formerly required to determine economical thicknesses. The book also features detailed drawings that show how single-layer insulation is applied to various vertical and horizontal expansion joints as well as to pipe bends, flanges, valves and fittings. Charts and tables list physical and thermal characteristics. Union Asbestos & Rubber Co.

246 Duct Insulation — Engineering data and application instructions for company's semi-rigid, spun mineral wool duct insulation are presented in this informative bulletin. Thermal and sound absorption characteristics are presented in tabular form and physical, chemical, mechanical properties given. Baldwin-Hill Co.

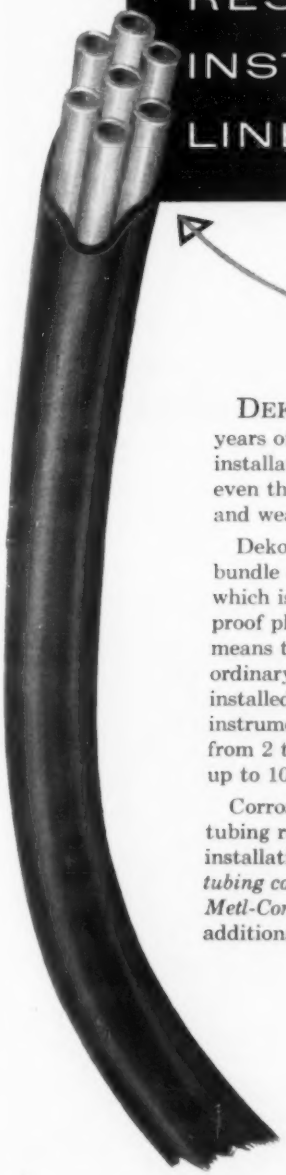
247 Underground Pipe Insulation — This illustrated bulletin discusses the problems of underground pipe insulation and explains how company's insulation for hot underground pipes overcomes them. On-the-job photos illustrate ease of application; brief technical data are also included. American Gilsonite Co.

TUBING AND ACCESSORIES

248 Heat Exchanger Tubing — Cited in this 30-pp catalog are typical cases where cupro-nickel or Monel tubing installed in heat exchangers resulted in substantial savings and better efficiency through longer tube life. Describes applications of this tubing in various instances where unusual water conditions, as to pollution, excessive turbulence, temperature

DEKORON PRODUCTS CUT INSTRUMENT TUBING COSTS

CORROSION RESISTANT METAL INSTRUMENT LINE HARNESS



DEKORON Metl-Cor®, tried and proven in years of service in literally thousands of installations, is impervious to attack from even the most corrosive industrial atmospheres and weather conditions.

Dekoron Metl-Cor is a multiple tube bundle of copper or aluminum tubes over which is extruded a thick sheath of corrosion-proof plastic. This harnessed construction means that it costs much less to install than ordinary metal tubing because many tubes are installed at one handling. Metl-Cor instrument line harness is available with from 2 to 19 (7 *illustrated*) tubes per bundle, up to 1000 ft. in length.

Corrosion resistance . . . elimination of tubing replacements . . . ease and speed of installation—*no other metal instrument tubing can compare with patented Dekoron Metl-Cor*. Request Bulletin 456 for additional information.

AA-4805

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quality research service

SAMUEL MOORE & COMPANY • MANTUA, OHIO

DEKORON PRODUCTS DIVISION

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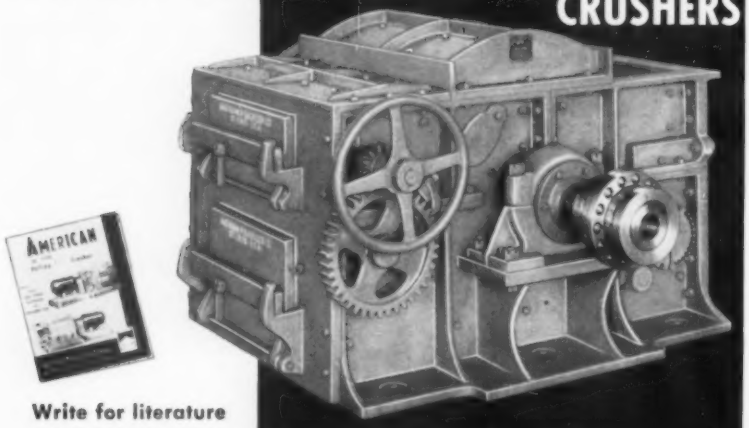
AMERICAN AC ROLLING RING COAL CRUSHERS



Write for literature on American's AC crushers

for uniform coal reduction rely on coal crushers backed by American's 50 years of experience

American PULVERIZER COMPANY

ORIGINATORS AND MANUFACTURERS OF RING CRUSHERS AND PULVERIZERS

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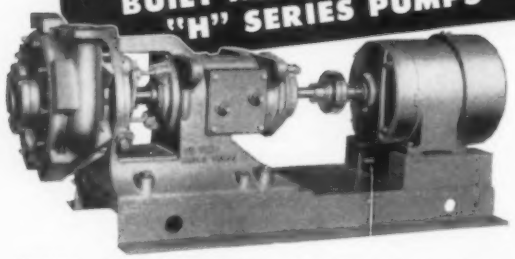
"INTESTINAL FORTITUDE" BUILT INTO NEW NAGLE "H" SERIES PUMPS



The new "H" Series of Nagle Pumps, designed exclusively for the abusive pumping jobs of industry, is simplicity itself. Three types of water ends available to meet specific conditions, type "HF", "HC" and "HR" (shown). Various alloys used for water-end members depending upon corrosive, abrasive or high temperature conditions involved. Water-end can be rotated to any one of four discharge positions. Slippage seal adjustment takes only moments using a common wrench. Packing gland is readily accessible. Radial adjustment of shaft to insure concentricity through stuffing box is a matter of seconds. Various types of impellers available. Impellers readily accessible. Oil or grease lubrication is optional. Sizes from 1" to 10". Heads up to 250' or more. Capacities to 4,000 G.P.M. A "must" for those tough applications where ordinary pumps fail. Send for Bulletin "H"

NAGLE PUMPS

NAGLE PUMPS, INC.

1229 CENTER AVE., CHICAGO HEIGHTS, ILL.

PUMPS FOR ABRASIVE AND CORROSIVE APPLICATIONS

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and the like, required such tubing. The International Nickel Co., Inc.

249 Tube Expanders — Catalog 88, 119-pp, is full of detailed information about tube expanders and associated tools used for tube rolling. Profusely illustrated, catalog provides information relative to boilers, condensers, evaporators or miscellaneous heat exchangers. Special sections are devoted to expanders, accessories, measuring instruments, rollers, extensions and drives. Each type of equipment is fully described, applications are listed, and tables of engineering data included. Also covers tube expansion methods, tool maintenance, expansion calculations and charts giving sizes. Thomas C. Wilson, Inc.

250 Tube Expanders, Cutters — Catalog 81, 32 pp, contains specifications of company's line of tube cutters and expanders for fire tube and water tube boilers, condensers-coolers, heat transfer units, refinery still tubes, others. Also gives necessary information on operating accessories. Many excellent demonstrations of product application are included among the 300 illustrations provided, as well as tables of sizes, ordering tips and distributors. The Gustav Wiedeke Co.

251 Electric Tube Cleaners — Bulletin E107 describes advantages and applications of company's electric tube cleaners for boilers, condensers, evaporators, and heat-exchangers. Tables are included giving complete specification details. Elliott Co.-Roto Plant, Div. of Carrier Corp.

COAL AND ASH HANDLING

252 Shredders, Crushers — Bulletin 257 describes and illustrates hammermills and shredders, rolling ring and special crushers for reducing chemicals, minerals, ceramics, and other materials including wood waste. Discusses construction features of the line and includes dimensions. American Pulverizer Co.

253 Improved Crushers — Bulletin 12-C, 16-pp, describes company's line of crushers for reducing coal, coke, glass cullet, gypsum, lime, metal turning, sugar, sulphur and similar lump materials. Covers Knittel ring type crushers, two-stage double-roll crushers, single-roll crushers, and double-roll crushers. Photos, dimensional drawings and full specifications are included. Stephens-Adamson Mfg. Co.

254 Water-Cooled Stoker — Design and operating advantages of the Vibragrate Stoker are outlined in this illustrated bulletin. A large cutaway view details component parts of the stoker and explains operating features. Other drawings show installations. American Engineering Co.

255 Jet Ignition Stoker — Information regarding company's jet ignition stoker is presented in Bulletin G-85. Rapid response to load change, ignition stability, efficient combustion, and a simple hydraulic drive are features described. Jet ignition stokers adapted to boilers in specific industries are shown and a typical fuel chart with comments and ASTM rank is also included. Babcock & Wilcox Co.

256 Why Liquid Diffusion — What liquid diffusion can do for power plants is explained in Form B, which tells how liquid diffusion compounds work and gives four practical applications. These include dust control in coal handling, fly-ash control, coal storage pile treatment and boiler cleaning. Johnson-March Corp.

FUEL BURNING EQUIPMENT

257 Oil and Gas Burners — Bulletin OB-53, 28 pp, gives principles of selection and application of oil or gas burners, or a combination of both for standard and wide capacity range operation, together with air registers and fuel oil heating and pumping sets. Conversion table shows approximate relationships between quantity of oil burned, boiler capacity and air required for combustion. The Engineer Co.

258 For Burning Refuse Fuel — This 8-pp bulletin describes refuse fuel burning equipment, including a pneumatic refuse fuel distributor which spreads refuse fuels such as bark, wood chips, and bagasse uniformly over the grate surface. Discusses construction features of various components. Riley Stoker Corp.

259 Steam Atomizing Oil Burners — Sixteen-pp illustrated Bulletin 21 describes steam atomizing oil burners and auxiliary equipment for use with heavy oil or tar in boilers, stills, dryers and other furnaces where steam or compressed air is available for atomizing the oil. Includes information on furnace design and construction. National Airoil Burner Co., Inc.

WATER CONDITIONING

260 Feedwater Heaters — Open-Coil, tray-type feedwater heaters and purifiers of both deaerating and non-deaerating type are presented in 12-pp Bulletin 117-A. Construction and operational features of the heaters are explained and illustrated, and more than a dozen available models are pictured along with application suggestions. They cover capacities from 3000 to 300,000 lb per hour. Stickle Steam Specialties Co.

261 Water Treatment—Bulletin 5000, 24 pp, explains the reason for boiler water treatment and tells services offered by company in providing formulations for individual plant requirements. Covers pretreatment, internal treatment, treatment application, blow-down adjustment, test control. Dearborn Chemical Co.

262 Feed Water Deoxygenation — The advantages of chemical deoxygenation of boiler feed water with an aqueous solution of hydrazine are described in 12-pp Bulletin BW 5. How hydrazine serves to maintain boiler in cleanest possible condition, reducing iron oxide scale to a magnetic oxide, is fully detailed, and such considerations as economy and operation, handling precautions, storage are covered. Fairmount Chemical Co., Inc.

263 Steam System Treatment — This bulletin on Coravol for prevention of corrosion explains theory of corrosion, application of organic amines to steam systems (Coravol process) and presents case histories of use in different types of plants and industries. Coravol is part of a complete technical service providing chemical formulas for treatment of water, steam, brine, fuel. Western Chemical Co.

264 Corrosion Treatment — "Corrosion Protection of Steam and Condensate Return Systems" is a folder on amine treatment for boiler and condensate systems. This treatment is described as affording surface protection of the metal as well as raising the pH value of the condensate. The Bird-Archer Co.

265 For Boiler Protection — Scav-Ox, a 35 per cent hydrazine solution for

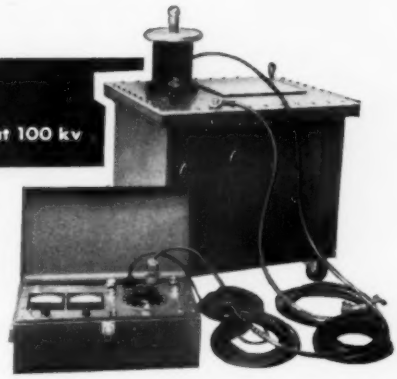
BIDDLE DIELECTRIC TEST EQUIPMENT

. . . for measuring direct current at voltages up to 100 kv when applied to the insulation of generators, transformers, bushings, cable, etc.

New

MODEL 2

current output 6 ma continuous at 100 kv



More and more engineers are leaning to d-c testing with voltages equal to or somewhat greater than equivalent peak alternating voltages. Their experience and increased knowledge and appreciation of the advantages of testing with direct voltage have accelerated the need for test equipment to meet field requirements.

IMPORTANT FEATURES

- Well-designed provisions for utmost safety
- Simple operation and reliable performance
- Excellent output voltage regulation
- Compact, mobile design
- Facilities for voltage and leakage current measurements

IMPORTANT APPLICATIONS

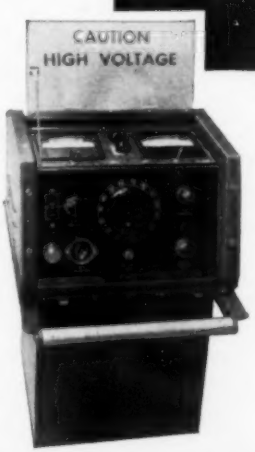
. . . *in development* . . . for testing the d-c dielectric strength of insulating materials and the adequacy of the electric design of insulation in any type of electrical equipment.

. . . *in production* . . . for non-destructively detecting defects in the insulation of electrical equipment due to design, material, and workmanship.

New

MODEL 1-A

3 ma continuous at 40 kv



. . . *in maintenance* . . . for non-destructively detecting unreliable condition of insulation of new or repaired electrical equipment. Preventive maintenance tests on important rotating equipment, cable, switchgear, etc., result in appreciable savings.

For important details regarding these units and information on the subject of high voltage d-c testing *write for our New Bulletin 22-PE.*

B-800

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ELECTRICAL TESTING INSTRUMENTS • SPEED MEASURING INSTRUMENTS
LABORATORY & SCIENTIFIC EQUIPMENT

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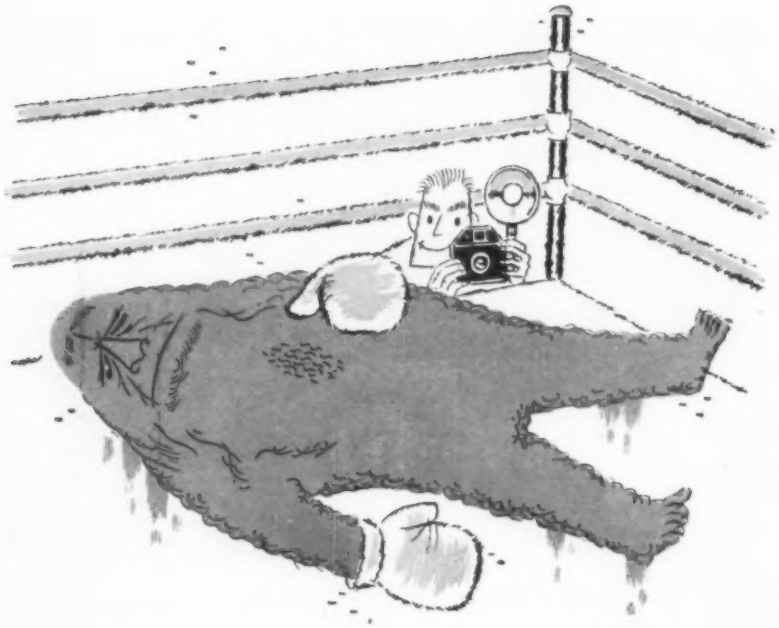

K. O. algae scum

in spray towers • condensers air conditioning systems reservoirs • cooling ponds

Count out costly algae problems in your recirculating water systems with HTH Granular: the modern *dry* chlorine product that knocks out algae growths in short order.

Left alone, algae can clog up filters and small pipes, cause heat transfer loss and generate offensive odors. One ounce of HTH per 1,000 gallons of water is usually enough to control these troublemaking growths. From then on, only periodic "shot" treatments are needed, varying, of course, with the condition and source of the water supply.

Safe and economical, simple and easy to use, HTH Granular, containing 70% available chlorine, will clean up your algae problems for good. HTH Granular comes in 100-lb. drums and in cases of nine 5-lb. cans. If your supplier can't tell you all about HTH, just write—

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5594

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removing dissolved oxygen from boiler feedwater, is described in this 16-pp illustrated booklet. It covers in detail the use of the solution for protecting low, medium and high pressure boilers, discussing determination of dosage, recommended methods of application, testing methods for hydrazine, and properties and handling of the material. Comprehensive operating data given. Olin Mathieson Chemical Corp.

266 Valveless Filter — Operation of company's automatic valveless filter is described in this 8-pp illustrated bulletin. Applications and typical operating conditions are detailed and diagrams and photos are included. The Permutit Co.

267 Data on Deaeration — This series of bulletins presents company's line of deaerating equipment for removal of dissolved gases from boiler feedwater, etc. Publication 4651 describes Jet-Tray deaerators; No. 4652 covers tray-type units. No. 4653 deals with cold water deaerators used primarily to reduce or eliminate corrosion of piping systems, heat exchangers. No. 4654 describes a surface-type deaerating hot water heater for commercial and institutional use. No. 4643 covers self-contained Uni-Pac deaerators for small and medium size power plants. No. 4635, 12 pp, on atomizing deaerators, details deaeration by atomization and its applications. Cochrane Corp.

268 pH and Chlorine Control — The 12th edition of company's handbook "Modern pH and Chlorine Control," 100-pp, incorporating theory and practice of colorimetric analysis, serves as a reference for quantitative determination of pH, chlorine, phosphate, nitrate, sulfate, hardness and other tests. Slide comparators and complete test kits are illustrated. In addition to standard pH determinations, methods are outlined for quantitative analyses of phosphate, calcium, magnesium, silica nitrate hardness. Available to qualified power engineers. W. A. Taylor Co.

269 Mixed-Bed De-Ionizers—Practical equipment for mixed-bed de-ionization at flow rates of 5 gph to 5000 gpm is described in this 8-pp bulletin. Advantages of construction and design are detailed, as well as mechanical features, installation operation. Illinois Water Treatment Co.

270 On Demineralization — Technical Reprint T-140, 24-pp, a profusely illustrated article on demineralization, discusses advantages and disadvantages of this process for today's power plants. Developments, trends and applications of both multi-bed and mixed-bed ion exchange are considered, and several case histories cited. A comprehensive bibliography lists 119 separate items. Tables, flow sheets, descriptive drawings, performance curves, process selection charts included. Graver Water Conditioning Co.

271 Cooling System Treatment — Bulletin C1 describes advantages of company's treatment for cooling tower systems with synergised polyphosphates. Details of the system are fully covered. National Aluminate Corp.

ELECTRICAL EQUIPMENT

272 Testing Instruments — Bulletin 19-58, 16 pp, features company's electrical testing instruments, including ohmmeters, ground testers, dielectric test sets, motor rotation tester, cable fault locating equipment, transformer turn ratio test sets, corona test equipment, frequency

meters, tachometers, others. Includes photos and descriptions of each type, including chief features, operating ranges, and applications. James G. Biddle Co.

273 On Copper Conductors — Publication C-25, 62 pp, is designed to help make the selection of bus conductors easier. Included in booklet are tables regarding such shapes as channels, ventilated square tubes and round tubes. There are tables for other rigid bus conductor shapes, also data on bare copper wire and cable as well as commonly used alloy wires. Also provided is a general discussion of copper, its physical and electrical properties. Photos illustrate many installations. The American Brass Co.

274 Selecting Protective Devices — The Protection Handbook, 24 pp, is based on the 1956 National Electrical Code, and interprets this code into easily read form. It covers the selection of protective devices for electric circuits, motors, appliances and apparatus, and includes a list showing the size to use when ordinary fuse, Fustron dual-element fuse or Fustat is installed. All information is condensed. Fully illustrated, book gives wiring diagrams, motor tables. Bussmann Mfg. Co.

Postage-free cards for ordering catalogs are on page 105. You may also use the cards to order literature mentioned in the ads.

275 Cable Troughs — This 12-pp catalog offers a simple solution to any design problem of change of direction or elevation with a complete set of standard fittings, horizontal elbows, inside and outside vertical elbows ties, crosses, covers and many special fastening devices to save time and labor. Contains full instructions for installations, load charts, accessory items, some typical installations and full list of distributors. The Globe Co.

CORROSION CONTROL

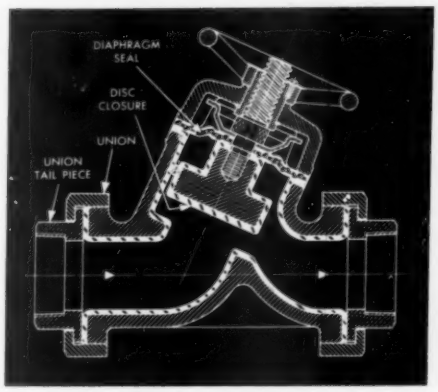
276 Corrosion, Abrasion Control — Modern practices and products for the positive protection of metal equipment from the effects of corrosion and abrasion are described in this 16-pp bulletin. Covers factory and field application of rubber or synthetic linings to metal parts or products, and maintenance coatings available for application by plant personnel. Goodall Rubber Co.

277 Guide to Corrosion Prevention — How Bitumastic protective coatings aid in fight against corrosion is told in this 12-pp booklet. Discusses corrosion as a universal industrial problem, role of protective coatings in cutting costs and lengthening service life of structures and equipment, and gives data on several coal tar-based coatings intended to solve a variety of corrosion problems. Twelve typical case histories covering use of these coatings in varied industries described. Koppers Co., Inc.

PACKINGS, SEALS

278 Packings and Gaskets — Catalog P-100C, 32 pp, covers 95 most popular packings and gaskets in company's line, furnishing details of construction, service recommendations and size information. In-

3 BIG ADVANTAGES in ROCKWELL "D—D" DIAPHRAGM VALVE



1 DIAPHRAGM FOR POSITIVE SEAL, fully supported, longer wearing. No packing gland to leak.

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3 UNION ENDS ideal where replacement or inspection must be frequent. Saves on companion flanges, gaskets, bolts, alignment, labor, etc.

as well as

Oversized ports—high capacity; lower handwheel torque and fewer turns to close; lower thrust for automatic operation; body of any metal or lined with rubber or plastics.

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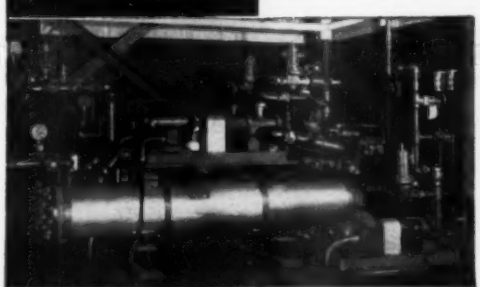
For heavy bunker oil or light furnace oil . . . 100 to 10,000 gallons per hour

Enco systems employ one, two or more pumps and heaters, interconnected so that full capacity is possible with any combination of pumps and heaters. Flexibility of design permits the use of any combination of rotary pumps, with motor or turbine drive; or piston type steam pumps. Any part may be cut out of operation for inspection or cleaning, without shutting down, where two or more pumps and heaters are included in the unit system.



Heaters are insulated and jacketed with removable heads at both ends for cleaning without breaking any piping connections or removing any tube bundles.

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eludes charts showing applications. Packing Div., Raybestos-Manhattan, Inc.

279 Mechanical Packings — Featured in 24-pp Catalog 56 are several recent packing developments including the multi-purpose Bel-Vee V-Ring packings, the long wearing criss-cross Braid packing series, twisted foil packings for oil and distillate temperatures to 1000 F, and an Inconel-wire reinforced plastic packing for valves handling superheated steam at temperatures up to 800 C. Packings for every industrial application are covered and a recommendation chart is included. The Belmont Packing & Rubber Co.

281 Packing Catalog — Catalog 54 contains literature on company's line of packings and gaskets to serve a variety of industrial needs. Among the items featured are metallic packings, fibrous packings, plastic packings, gaskets and sheet packing, as well as high-temperature anti-seize compounds. A section of engineering data and conversion tables is included. Felt Products Mfg. Co.

OTHER EQUIPMENT

282 Product Guide — Manufacturing facilities for company's line of steam turbines, turbine generators, ship propulsion units, feed pumps, centrifugal compressors, blowers, centrifugal pumps, reduction gear, and other products are described in this profusely illustrated 50-pp catalog. Photos show manufacturing procedure. De Laval Steam Turbine Co.

283 Precipitation Products— Twelve-pp Bulletin G406 contains helpful information on company's various precipitation products, including electrical precipitators, multiclone mechanical dust collectors, combination multiclone-precipitator units, Dualaire filter-type dust collectors and Holo-Flite processors. Also illustrates a number of typical installations. Western Precipitation Corp.

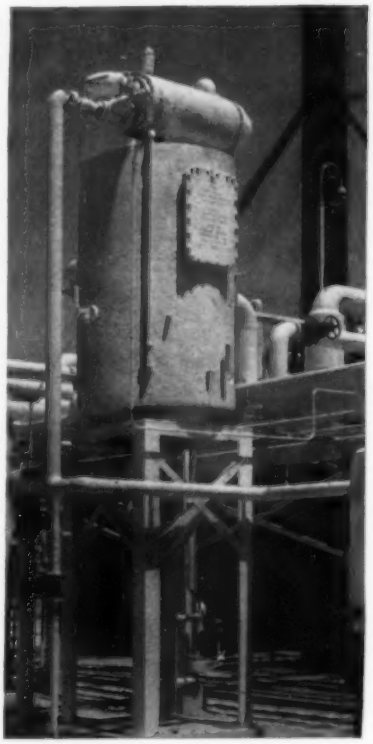
284 Sheet and Plate Fabrication — Illustrated in 40-pp Bulletin F-3 are products of this manufacturer, and equipment used to produce special sheet steel and alloy parts. Shows control panels, switch gear housings, cubicles and other electrical enclosures, boiler air ducts, smoke breechings, tanks. The Kirk & Blum Mfg. Co.

When ordering catalogs, allow time for us to relay your requests to the manufacturers—and for them to mail out copies. Remember, manufacturers are often swamped with catalog requests.

285 Electric Heating Units — Catalog 50, 50 pp, contains complete engineering data on electrical heating units and equipment, including strip elements, finstrip elements, tabular elements, cartridge elements, ring elements, immersion heaters, circulation heaters, radiant heaters, forced air duct heaters, unit heaters, hot plates and others. Includes photos, dimensional drawings, prices, standard rating tables, and specifications. Edwin L. Wiegand Co.

286 Ejector Data — This 12-pp bulletin presents company's steam jet air ejectors designed for efficient, low cost air

How to solve a feed water problem



A Texas oil refinery needed a packaged feed water heater rugged enough for exterior installation, and capable of delivering water at specified temperature even with 1" or more of encrustation on tray surfaces. Selected for the job was the Stickle unit shown above. Extra deep trays force water to flow irregularly in a thin film, depositing solids and releasing noncondensable gases. Trays cannot overflow; are easily removed for cleaning. Open coils bring feed water into direct contact with steam, immediately transmit heat to water. Condensed steam is not wasted. It provides one-sixth of boiler feed supply. There's a Stickle feed water heater for practically every need. Capacities 3,000 to 300,000 lbs. per hr. Stickle has built heaters since 1905; is well equipped to solve your feed water problem. Write for free bulletins.

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Cuts the cost of steam

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removal from condensers. Illustrates basic ejector assembly, and discusses principle of operation. Single- and multi-stage units are shown. Also described are steam jets for special services and air ejector accessories. Engineering data pertinent to ejector application in power plants, process plants and evaporators included. Condenser Service and Engineering Co., Inc.

287 Engineering For Atomic Power — How $400 million in coin silver weighing 14,000 tons were borrowed from the U. S. Treasurer for use as electrical conductors, at the atomic energy plant in Oak Ridge, during the war when copper was scarce, is told in this 36-pp illustrated booklet. Describes the firm's role in the development of atomic energy and outlines its activities in peacetime applications. Stone & Webster Engineering Corp.

288 Steam Turbines — The advantages of company's solid wheel turbines, axial flow turbines, single stage and multistage, are outlined in illustrated Bulletin S-140. Describes various models in their line and includes application photos. The Terry Steam Turbine Co.

289 Sectional Condenser — Bulletin 131 shows benefits of sectional-design refrigeration condensers for 100 to 240 tons refrigeration capacity and explains their functions with diagrams and installation photos. A cutaway shows component parts. Niagara Blower Co.

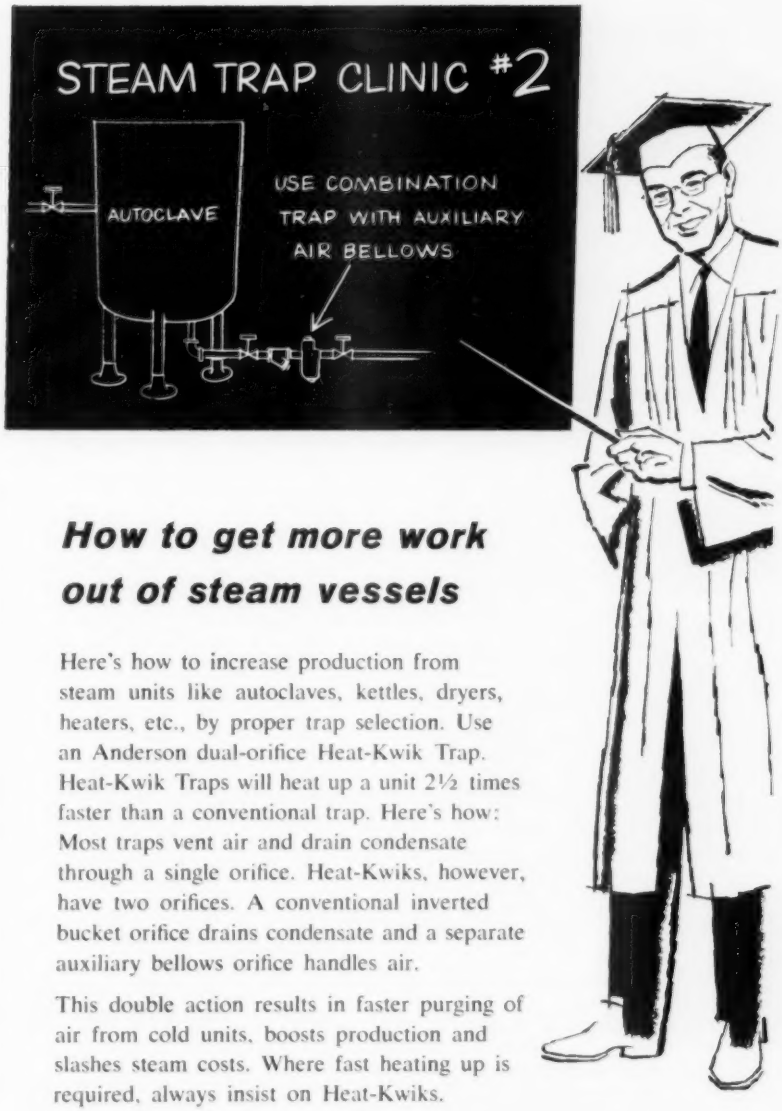
290 On Coal Burning Plants — Presented in this illustrated 20-pp booklet, "More and more firms are burning coal the modern way . . ." are eight case histories of notable coal burning plants. They include industrial, commercial and institution power plants both modernization and new construction. Economy and other advantages of coal as a fuel are stressed. Bituminous Coal Institute.

291 Ventilation Units—Bulletin FM-315, 25 pp, describes basic construction of company's package propeller fans for commercial and industrial applications. Illustrated case histories of typical installations are included, as well as performance data rating tables, performance charts. Buffalo Forge Co.

292 Turbine Speed Control — Thirty-pp wire-bound Bulletin H-21 is titled "Fundamentals of Turbine Speed Control." It is an elaborately illustrated, educational booklet intended to clarify operation of common types of automatic speed control for steam turbines. An introductory section covers general fundamentals of automatic control systems, and includes a key to control terminology. Simplified diagrams show operating principles of actual control systems. Elliott Co.

293 Humidification for Profit — Sixteen-pp Bulletin 500 presents data showing how relative humidity affects hygroscopic materials, health and comfort, and formation of static electricity. Schematic diagrams and sectional drawings demonstrate operation of electrically and air operated steam humidifiers. Armstrong Machine Works.

294 Power Plant Equipment — Bulletin 1022-B, 12 pp, describes various types of power plant equipment, including combustion control, boiler feed water control, pressure reducing, desuperheating, and soot blowing. Photos and drawings illustrating equipment are included. Copes-Vulcan Div., Blaw-Knox Co.



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Here's how to increase production from steam units like autoclaves, kettles, dryers, heaters, etc., by proper trap selection. Use an Anderson dual-orifice Heat-Kwik Trap. Heat-Kwik Traps will heat up a unit 2½ times faster than a conventional trap. Here's how: Most traps vent air and drain condensate through a single orifice. Heat-Kwiks, however, have two orifices. A conventional inverted bucket orifice drains condensate and a separate auxiliary bellows orifice handles air.

This double action results in faster purging of air from cold units, boosts production and slashes steam costs. Where fast heating up is required, always insist on Heat-Kwiks.

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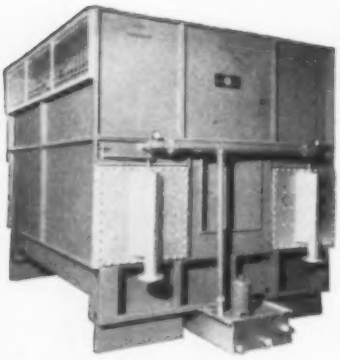

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High operational efficiency means: precise temperature for improved product and process quality control, heat removal at rate of input, simple operating conditions, real economy in upkeep, sustained full capacity.

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Niagara machines do the work of a cooling tower plus shell-and-tube coolers with a single machine that saves piping, water handling disposal and treatment expense and 95% of water consumed by contact cooling methods.

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EQUIPMENT NEWS

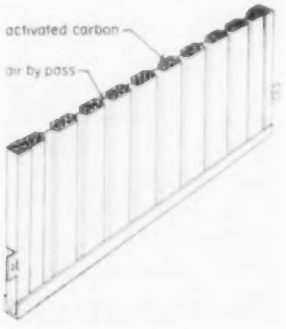
continued from page 102

30—FOOTLESS MOTOR offers more hp in less space

Designed for direct connection to driven equipment, this footless motor is supplied with a NEMA style C Unimount bracket for automatic alignment. Available in ratings from 1 to 30 hp, the motor is built to latest NEMA specifications, making it extremely compact — more horsepower in less space. Among its advanced features are a Ventrifoil deflector which directs air and deflects water; cast-iron, split-type conduit box for easy access to motor leads. Rotors are solid cast and dynamically balanced. U. S. Electrical Motors, Inc.

31—ODOR FILTERS for use with air conditioners

The Type R is described as a simple, low cost activated carbon air filter for commercial and other conditioners, either package or central systems where air is recirculated with no provision for outside air ventilation. The panel-shaped



filter has a metal frame supporting several densely packed columnar beds of activated carbon firmly held in wire mesh, interspersed by air by-passes. It fits directly behind the dust filter and is made in same dimensions as four standard sizes of the latter, ranging up to 20-by-25 in., capacities to 1000 cfm. At rated capacities resistance is given as 15 in. wg and efficiency as 20 per cent. Thus, on a 1000 cfm conditioner, 200 cfm of fresh, odor-free air is provided. When the filter medium becomes saturated, it can be replaced by fresh carbon. Bulletin 107 gives details. Connor Engineering Corp.

Reader Service Cards on pages 105–106 make it easy to get further information on any of these products. Just circle the item numbers of the products you want to know more about.

32—PACKAGED BOILER has lower required air pressure

The Steam-Pak automatic boiler line features a burner head designed for efficient firing of natural or mixed gas

Liquid Heating Problems?

Your Chromalox Man has the ANSWERS

Backed by the industry's most complete line of electric heaters, he has heaters specifically designed for oils, water, asphalt, paraffin, salt baths, corrosive solutions and heat transfer media. Standard heaters are ready for immediate shipment from the world's largest stock.

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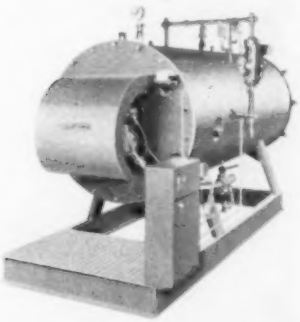
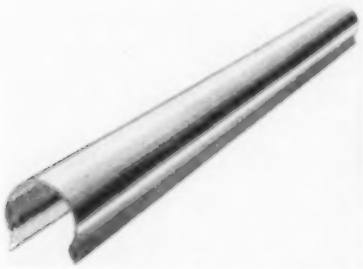
and proper mixing of air and gas. Air for combustion is supplied by a blower at front of boiler, which also forces hot gases through boiler passes. According to company, the improved design reduces required air pressure; hence blower motor is smaller and electricity costs less per boiler hp developed. The



low-pressure blower also results in more quiet operation. Everything needed — boiler, accessories and controls — are included in the integrated package. Controls have been simplified and are centralized in an enclosed control panel on one side of boiler. The boilers are presently available in 12 sizes from 30 to 125 hp. York-Shipley, Inc.

33—STAINLESS SHEATH for condenser and boiler tubes

Snapit-on Protector Shield, for condenser and boiler tubes, is the snap-on type, made of stainless steel, and available in



lengths and sizes to fit most industrial needs. The shield, or sheath, is designed to deter corrosion and prevent material wastage and to extend the life of original equipment. Vince Basnik Co.

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CHIMNEYS
FURNACE WORK
BOILER SETTINGS

AMERICAN CHIMNEY CORP.
143 Fourth Ave., New York 3, N. Y.
BRANCHES: CHICAGO
BOSTON • PHILADELPHIA • CLEVELAND
DETROIT • RICHMOND, VA. • CINCINNATI, OHIO

For more data circle 567 on Post Card

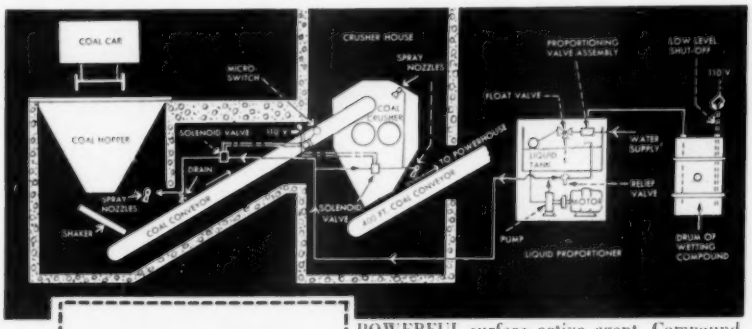
DEOXY-SOL
SOLUTION OF HYDRAZINE

- Oxygen-
- Scavenger
- for
- Boiler Water
- Treatment

FAIRMOUNT
CHEMICAL CO., INC.
136 Liberty St., New York 6, N.Y.
Midwestern Representative:
J. H. DeLamar & Son, Inc.
4529 No. Kedzie Avenue
Chicago 25, Ill.
Ask for pamphlet BW-7

For more data circle 568 on Post Card

JOHNSON MARCH ► chem-jet DUST CONTROL SYSTEM



POWERFUL surface active agent, Compound M-R, treats coal at four critical points in a power plant.

LOW COST:
Investment
Operation
Maintenance

...typical users of Chem-jet Dust Control Systems:

- Consolidated Edison Co.
- Philadelphia Electric Co.
- Niagara Mohawk Power Corp.
- Public Service Co. of Colo.
- Georgia Power Co.
- N. J. Power & Light Corp.
- Metropolitan Edison Co.

HOW LOW-COST CHEM-JET STOPS DUST AT ITS SOURCE

- **Effective Dust Control—**
  Chem-jet attacks a dust problem by allaying the dust before it is airborne.
- **Low Cost System—**
  Low first cost, low operating costs, low maintenance cost.
- **Engineered Package—**
  Chem-jet can be engineered for widely varying conditions. Installation is supervised, each system designed for specific problems.
- **Compact Design—**
  Eliminates bulky hoods, ducts and fans, and extra costs of collection and disposal.

Get complete facts on low cost Chem-jet, the only system of its kind. Write today to Johnson-March Corp., 1724 Chestnut St., Philadelphia 3, Pa. Ask for Bulletin CJ-1.

JOHNSON MARCH
DUST CONTROL ENGINEERS
1724 Chestnut Street, Philadelphia 3, Pa.

For more data circle 569 on Post Card

KO9

...the amazing electric motor cleaner!

KO9—your Short Cut to clean electrical equipment—does an outstanding job of cleaning and degreasing motors, generators, controllers, switches, panels, instruments, meters, refrigeration lines, etc.

Cleaning motors is a cinch—all you do is immerse the running motor in KO9, remove it minutes later as clean as new!

KO13 . . . YOUR SHORT CUT TO FAST, SAFE CLEANING

KO13 is a truly sensational general purpose safety solvent that will clean just about everything . . . leaves surfaces smooth and sparkling clean!

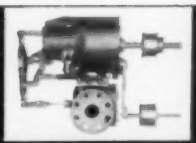
KO13 quickly removes grease, oil, dirt and grime from metal, wood and paint.

Ask for Literature Today

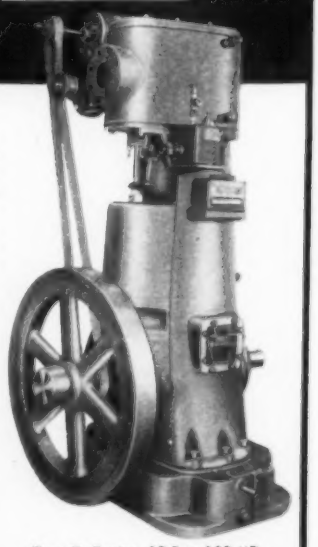
KOR CORPORATION
600 W. 9th AVENUE
GARY, INDIANA

For more data circle 570 on Post Card

STOP WASTING STEAM



Type EN Governor Fully enclosed, Self-lubricated



Let Troy Steam Engines and Generators produce dollar-saving "BY-PRODUCT POWER" from steam available for processing or heating. You can use this low-cost power for many operations in your plant, even against high back pressures!

Use it for—

Generating Electrical Power

Mechanically Driving stokers, pumps, fans, compressors and other equipment.

It will pay you to investigate this source of cheaper power. TROY Equipment can be your key to COST REDUCTION!

Send for Booklet #306.

Type E. Engine, 12.5 to 100 HP.

TROY Engine & Machine Co.
704 Parsons Street Troy, Pennsylvania Tel. Troy 32

For more data circle 571 on Post Card

Solve your toughest HI-TEMP THREAD Problems with C-5

SEND FOR TEST SAMPLE FREE

No More SEIZING or GALLING of STUDS, Even at 1800°F

- √ Prevents stud breakage
- √ Eliminates pitting of Stainless Steel
- √ Reduces Torque
- √ Speeds up Disassembly

NOW, being used for boiler, manhole, handhole and face plate studs, turbine header studs, flange bolts on high temperature valves, steam lines, pumps, etc. 844PRR

C-5 FEL-PRO "HI-TEMP" ANTI-SEIZE THREAD COMPOUND

Fel-Pro's exclusive C-5 colloidal-copper formula "copper-plates" metal . . . gives maximum cushioning and protection up to 1800°F without breakdown. Prevents galvanic action—eliminates pitting even where dissimilar metals are joined. Protects all threaded surfaces of bolts, plugs and studs, insuring their repeated re-use.

SEND FOR FREE SAMPLE TODAY on your company letterhead.

FELT PRODUCTS MFG. CO.
7476 N. McCormick Blvd., P.O. Box 8609, Chicago 80, Ill.

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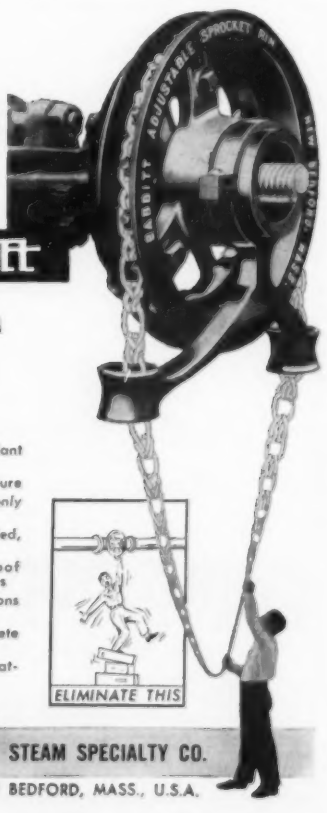
Safe Operation of Overhead Valves with a



Babbitt

Adjustable
SPROCKET RIM
with Chain Guide

- Simplifies pipe layout
- Fits any size valve wheel
- Easy to install and operate
- Operates any valve from plant floor
- Time and money saving fixture
- No maintenance, first cost only cost
- Packed, completely assembled, one to a carton
- Hot galvanized, rust-proof chain available for all sizes
- Easy to follow instructions with each unit
- Your supplier carries complete stocks
- Write for new descriptive catalog sheet and prices

Babbitt STEAM SPECIALTY CO.
4 BABBITT SQUARE, NEW BEDFORD, MASS., U.S.A.

For more data circle 573 on Post Card

POWER ENGINEERING is a member of BPA

what is BPA?

BPA (Business Publications Audit of Circulation, Inc.) is a non-profit organization of advertisers, advertising agencies and publishers. BPA audits the circulation of member publications for the benefit of advertisers and agencies who buy advertising space in these publications.

what does it do?

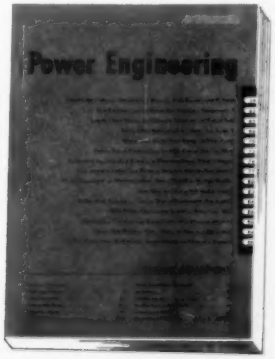
BPA supplies detailed, verified information through an independent, unbiased audit of its member publications. The advertisers, therefore, can judge whether the specific audience (readers) are logical prospects for his product or service, how many there are, where located, what industries they work in, etc.

why is BPA important to you the reader?

When Mr. Advertiser buys advertising space in POWER ENGINEERING, for example, he actually provides the money to pay for the outstanding editorial service we render you. And the more he knows about you (through BPA, of course) the more advertising space he buys.

Power Engineering BPA

TECHNICAL PUBLISHING COMPANY
308 E. JAMES STREET, BARRINGTON, ILLINOIS



HOW TO SELECT WATER-CONDITIONING EQUIPMENT (NO. 5 OF A SERIES)

Ion Exchange Equipment

Ion exchangers are solids which can take a "charge" of cations or anions from one liquid and exchange them for different ions of the same polarity in another liquid. Example: "Permutit Q" Cation Exchanger, a sulfonated polystyrene resin. When operated on the "sodium cycle," this resin picks up calcium, magnesium, iron, manganese or aluminum cations from water containing these materials and gives off sodium cations in exchange. When exhausted, the resin is regenerated with a brine (sodium chloride) solution that supplies new sodium cations.

The Table below lists ions commonly found in water and the ion-exchange systems by which they can be removed.

Softening: Removing calcium and magnesium ions that cause boiler scale, soap curd, etc. Done with a cation exchanger, sodium cycle, which also removes iron, manganese and aluminum ions.

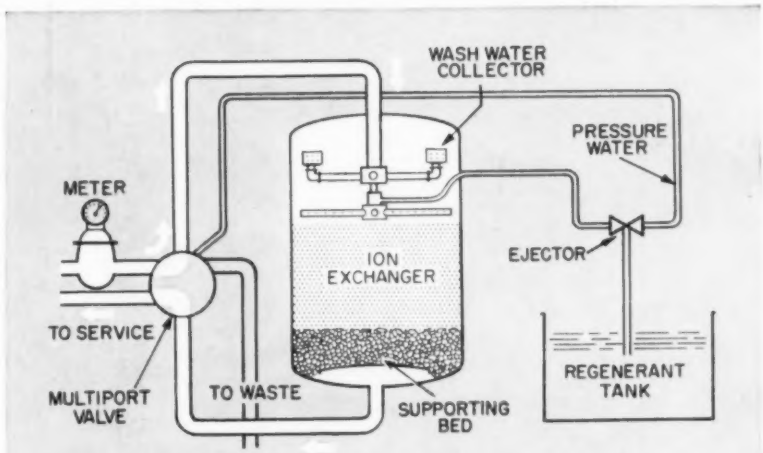
Dealkalizing: Removing bicarbonates and carbonates, generally from boiler feedwater, to reduce corrosion due to CO_2 in condensate returns. Done in 2 steps: cation exchanger, sodium cycle, then strongly basic anion exchanger, chloride cycle.

Demineralizing: Removing cations and anions. Up to nine or ten combinations of exchangers with one to four steps are used depending on the raw water and the degree of purity required for a specific use.

Functions of equipment

Ion exchange equipment is designed to accomplish these basic cycles: The *service run* during which the water flows through the bed of ion exchanger (usually downflow); *backwashing* (upflow) for removing suspended solids filtered out by the ion exchanger; *regenerant introduction* (either upflow or downflow) which restores the capacity of the ion exchanger and *rinsing* which removes the excess regenerant from the bed.

A manual or automatic motor-driven multiport valve replaces a number of individual valves and greatly simplifies regeneration. Rubber-lined multiport valves are used under corrosive conditions.



SINGLE-BED ION EXCHANGE UNIT

Length of service run is usually controlled by the volume of water through an electric-contact water meter or by automatic water-quality testing instruments such as a conductivity meter.

SINGLE-BED UNITS for softening, dealkalizing, demineralizing

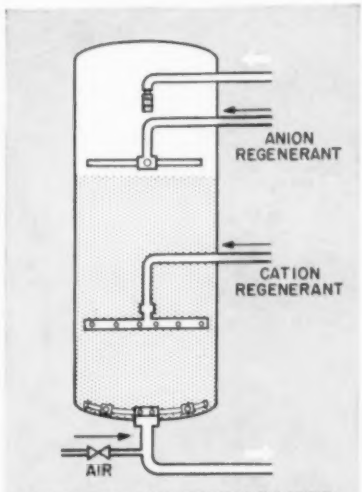
These units contain one type of ion exchanger (cation or weakly basic anion or strongly basic anion). They are similar to pressure filters with ion exchanger in place of the sand and a more efficient distribution and collection system for more uniform flow through the bed.

Two or more single-bed units are required for demineralizing . . . one or more for a cation exchanger and one or more for each type of anion exchanger used.

MIXED-BED UNITS for demineralizing

Mixed-bed units contain both cation and anion exchangers. These are thoroughly mixed prior to the run and provide a multiple-step demineralization.

Backwash rate is closely controlled so that it separates the ion exchanger resins by lifting the lighter anion resin beds over the heavier cation resin. The beds are then regenerated and rinsed while separated, then mixed by air jets from the bottom of the tank and given a final downward rinse before the service run.



MIXED-BED ION EXCHANGE UNIT

CATIONS	Calcium Ca^{++}, Magnesium Mg^{++}, Iron Fe^{++}, Manganese Mn^{++}, Aluminum Al^{+++}	Exchanged for sodium ions by CATION EXCHANGER regen. with sodium chloride.	Exchanged for hydrogen ions by CATION EXCHANGER regen. with acid.		
	Sodium Na^{+}, Potassium K^{+}				
ANIONS	Chloride Cl^{-}, Sulfate $SO_4^{=}$, Nitrate NO_3^{-}	Taken up as complete acid molecule by WEAKLY BASIC ANION EXCHANGER regen. with soda ash or caustic.	Exchanged for chloride ions by STRONGLY BASIC ANION EXCHANGER regen. with sodium chloride.	Exchanged for hydroxyl ions by STRONGLY BASIC ANION EXCHANGER regen. with caustic.	
	Bicarbonate HCO_3^{-}, Carbonate $CO_3^{=}$				
	Silicate $HSiO_3^{-}$				

For information on ion exchange resins and equipment, as well as other water-conditioning equipment, write: The Permutit Company, Dept. PE-3, 50 West 44th Street, New York 36, N. Y. or Permutit Company of Canada, Ltd., Toronto 1, Ont.

PERMUTIT®

thymes with "compute it"

For more data circle 575 on Post Card